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TIMBER FOR LOW COST HOUSING *

IN THE PHILIPPINES

Prepared by

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INTRODUCTION

Looking back at how man provided himself with shelter, a basic need, we find that his resourcefulness has made him adapt to his environment. Progressing from living in caves to building his home with materials available around him, his ingenuity has similarly taught him how to process and to transform these indigenous materials to more durable products. Timber, for instance, has been transformed into plywood and hardboards. Technological advances have made it possible for him to manufacture substitute materials for practically any component in his house.

Similarly, technological advances made in transportation made it possible for him to acquire materials and products produced in other corners of the world more conveniently than developing a similar product locally. But with economic crises befalling him one after the other, he suddenly realizes that importing materials is beyond his means. Thus, he has to rely on his ingenuity once again to use whatever material is available to him in a manner his ancestors did or perhaps in a manner suited to his present day activities and his economic situation. Such is the case in most developing countries including the Philippines.

This paper discusses the traditional Filipino houses that have been the source of inspiration for present day housing.

Presented also are the various shelter designs that have been modified and simplified in response to each economic crisis. It highlights the use of timber, which is one material that is readily available in the country, in the three major shelter projects, namely Rural BLISS, Flexihomes, and Sariling Sikap. It likewise enumerates the progress in de-regulation in the various building and land development codes which do not discourage the use of locally available materials but promote them in order to encourage low cost housing.

THE TRADITIONAL HOUSES

A. "Bahay Kubo" - - The House on Stilts

The traditional Filipino house is one that is raised above the ground on stilts. Better known as "bahay kubo", Filipinos were living in this type of house long before the first colonizers landed on Philippine shores. The "bahay kubo", which until now is the most common shelter type in the rural areas, is constructed of light materials, which vary according to the available indigenous materials in the locality.

In the mountain settlements of the north, the Ifugao house on stilts is a hut measuring about 16 to 20 square meters. The stilts (posts), floors, framework, and wall panels are of hardwood, while the roof with a steep pitch is made of layers of grass. In the lowlands, the traditional "bahay kubo", is made mainly of bamboo and timber roofed with palm leaves. In fishing villages notably in the southern part of the country, the house on stilts is built right on the water with grass reeds for walling, logs with diameters of 10-15 cm for framework, and thatched roof.

The "bahay kubo" constructed of traditional materials is not as lasting and durable as the present day version, nor is it weather tight. Strong winds necessitate temporary propping and securing with bamboo or even fishnet. The flimsy wall sidings and roofing materials similarly are no match for the driving rains. Yet, the "bahay kubo", on the other hand, merely sways with an earthquake.

Described briefly below are the features of the traditional Filipino house, the "bahay kubo", in terms of layout and its elements.

1. LAYOUT

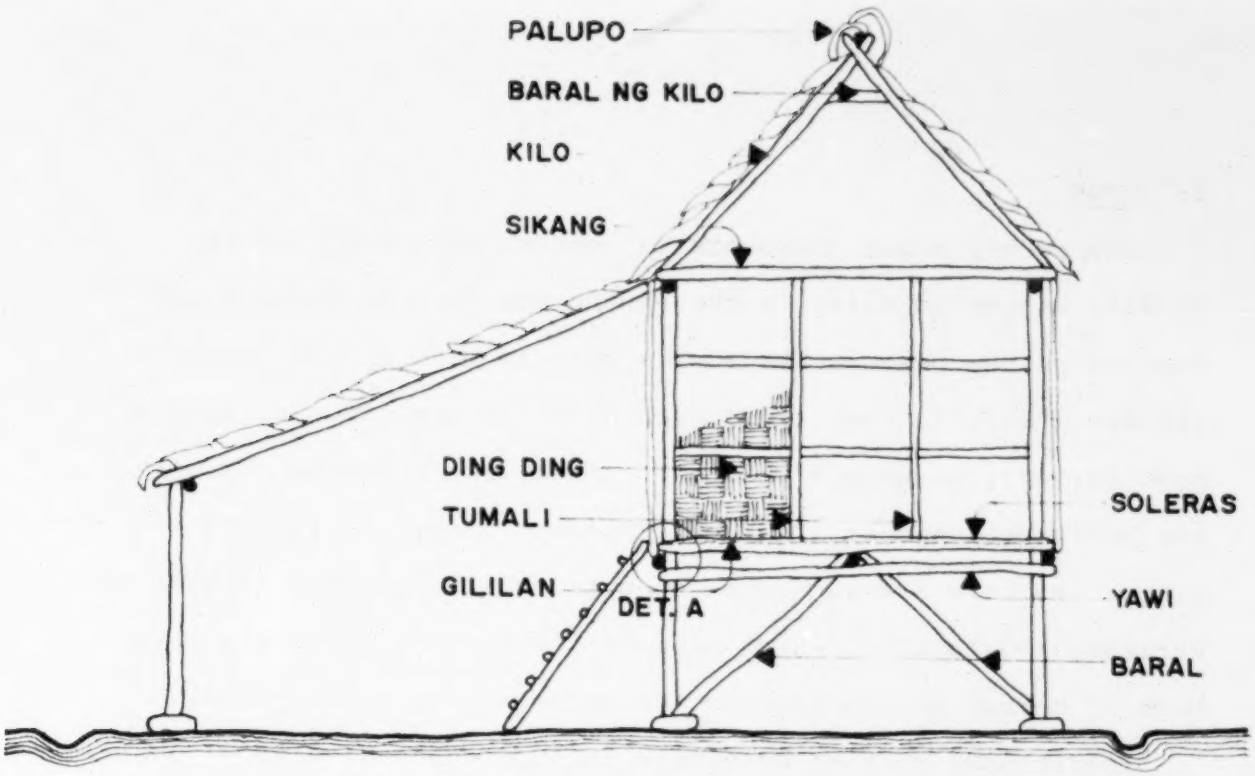
The elevated enclosed space of the basic "bahay kubo" is a sleeping area and storage space where personal articles are kept. Cooking is done on the ground under a shed or the extension of the roof. The area under the roof extension at the front is called the "harapan" which serves as social and entertainment space. The space underneath the elevated living area, called "silong", is where animals and farm implements are kept.

The bigger house on stilts would have a partition separating the sleeping room ("silid") from the hall, or multi-purpose area, ("bulwagan"). On one side of the "bulwagan" is the kitchen which sometimes is a separate structure. A feature of the kitchen is the "banggera" a slotted shelf protruding much like a bay window, where pots and dishes are drained. Toilets were separated from the main house. A porch or "veranda" is also an added feature of the "bahay kubo" located at the front and sometimes also at the rear of the house.

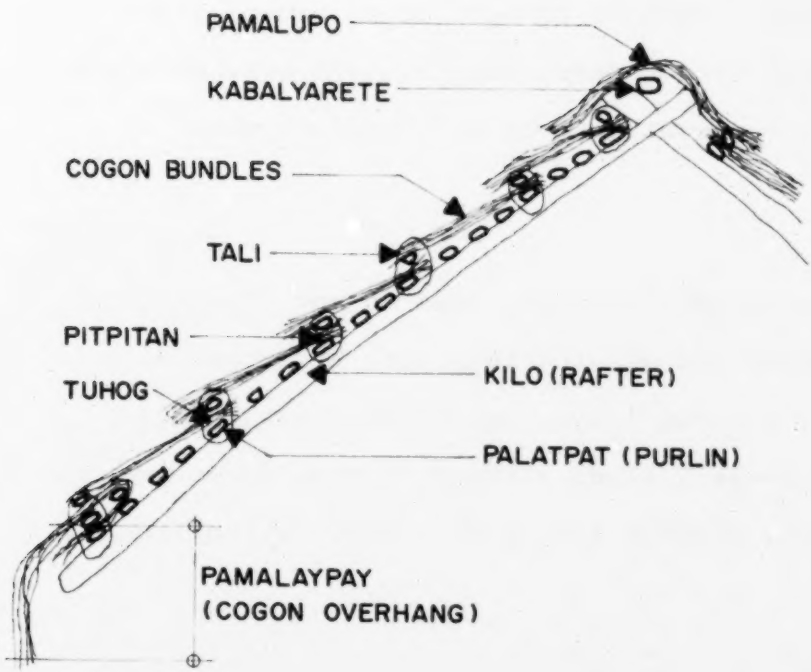
2. POSTS AND BEAMS

Posts, ("haligue") are either set on flat stone slabs or buried in holes and kept in place by setting rocks around the posts. Among the wood species used for posts are: mòlave (Vitex parviflora), ipil (Instia bijuga), banaba (Lagerstroemia speciosa, pers.), yakal (Shorea gisok), and bamboo.

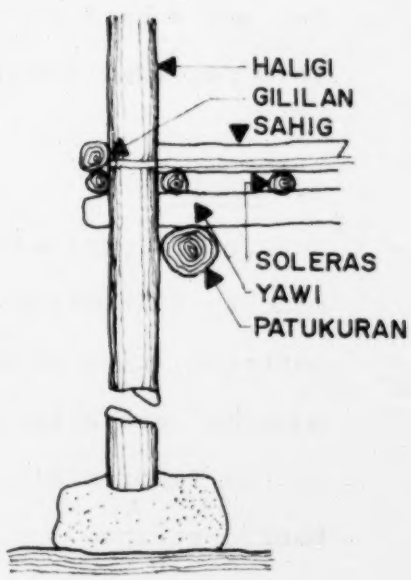
Beams ("patukuran") tie up adjacent posts and serve as the major structural support to the floor system. Secondary beams ("yawi") usually running in the direction of the shorter span support the joists ("solera") upon which the actual flooring is laid.



SECTION



DETAILS OF ROOF



DETAIL A

CONSTRUCTION DETAILS OF BAHAY KUBO

3. ROOF

Before any other framework is constructed, the roof is usually assembled first on the ground and then is hoisted and mounted on the posts. The roof system is made up of pairs of rafters ("kilo"), that cross each other at the ridge to form a seat for a ridge beam ("palupo"). Much like a bottom chord is the horizontal member ("sikang") holding a pair of rafters in place. Rafters are supported on both ends by girders ("kahab-an"). Purlins, ("palapat"), which support the roofing materials, are made of bamboo strips tied to the rafters with rattan vines.

Traditional roofing materials include cogon (a kind of grass), and nipa palm leaves (made into shingles). The roof is pitched steeply to drain off rain easily.

4. FLOORING

Traditional flooring ("sahig") is made up of bamboo slats, two and a half centemeters on centers leaving gaps between slats. This provided adequate ventilation even with windows shut.

5. WALLS

Traditional wall sidings, include: bamboo mat ("sawali") made by flattening bamboo and weaving this into herringbone patterns, nipa leaves, coconut leaves and cogon grass. Wall sidings are attached to wall studs ("tumali") that are seated on the floor sill. Wall sidings are held in place by horizontal bamboo strips.

6. DOORS AND WINDOWS

Traditional windows and doors are made up of the same materials as the walls. The "bahay kubo" window is either a projected or pivoted type which is held open with a bamboo prop.

7. USE OF MODERN MATERIALS

Most of the present day "bahay kubo" utilize materials that are more lasting and permanent. Wood has replaced bamboo for its structural members anchored and fastened with nails and bolts rather than rattan lashings. Planks and wood boards are commonly used for floors, and hardboards, asbestos sheets and wood for wall sidings. Corrugated galvanized roofing has replaced the highly pervious and flammable nipa roofing.

B. BAHAY NA BATO

The coming of the first colonizers in the 16th century saw the advent of new construction technology and new materials. Stones, lime, bricks and clay roofing tiles were introduced. Houses built by the Spanish before the year 1645, were usually two stories high and were predominantly of stone and clay tiles. Earthquakes in 1645, 1658 and 1677, however, leveled practically all stone houses, and the colonizers had to shift to timber for major structural members.

Houses of the affluent, thus, had timber posts enclosed and wrapped in masonry which supported the upper floor and the roof trusses. The stone exterior walls were retained, but no longer carried any load. The second floor framing and flooring were

all of timber, and seldom was the exterior wall on the second floor, not made of wood.

The "bahay na bato" (literally translated as "house made of stone") has been built taking into account the tropical climate of the country. It is characterized by verandahs, very wide sliding windows (oftentimes extending from wall to wall), equally wide window awnings and steep roofs. Houses of this type were prevalent till the coming of the Americans at the close of the 19th century. The introduction of concrete hollow blocks saw the beginning of bungalow-type mass housing in the post war period.

RURAL BLISS PROGRAM

The government's response to the housing problem was triggered in the 1950's by the emerging squatter problem in Manila. The year 1978 saw the Ministry of Human Settlements embarking on a massive housing program along the principles of the human settlements approach.

Housing was viewed not solely as the provision of dwelling units with the accompanying facilities but rather as the development of communities that are self-sufficient, self managed, and self reliant. Thus, the Rural Bliss Program was initiated.

The objective of the Bagong Lipunan (New Society) Sites and Services Program, better known as BLISS, was to establish communities of at least 50 families each; in all 1,500 municipalities nationwide to serve as the model and foundation of self-reliant communities. The program was not merely a housing program, since it was also geared towards establishing income and employment opportunities not only to the housing beneficiaries, but also to the residents of the surrounding adjacent communities.

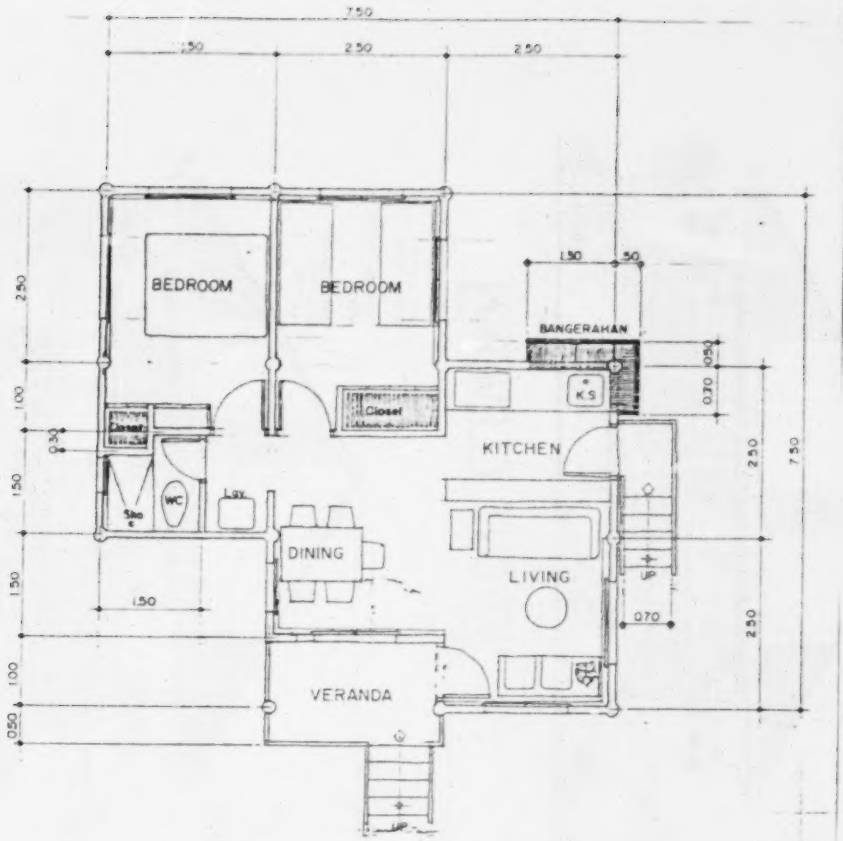
The Rural BLISS Program also saw the emergence of an interest among the policy makers to preserve the legacy of Philippine shelter architecture. This was explicitly embodied in two of the major policy directives, namely; (1) to design the houses along Filipino regional architectural motifs, and (2) to use indigenous housing materials.

The next few illustrations are examples of plans prepared by architects in response to this challenge of designing a low cost dwelling unit adopting architectural motifs and details

from traditional houses using local materials, such as bamboo, wood, stones, clay, nipa, cogon and bricks.

The house on stilts was one of the more practical adoptions made from traditional homes, since it afforded the people a covered space where livelihood activities can be performed.

The use of traditional indigenous materials was not always acceptable to the people and the bank which provided financing. There was the question of the durability of materials, such as bamboo and nipa roofing, specifically because homeowners had to pay a long term amortization for the housing units. Homeowners were willing to pay the premium for more permanent materials such as corrugated galvanized iron roofing and concrete hollow blocks, which in a way was a status symbol for them. Wood was also preferred instead of bamboo or nipa wall sidings. Thus emerged houses in traditional designs but constructed with modern materials.



FLOOR PLAN

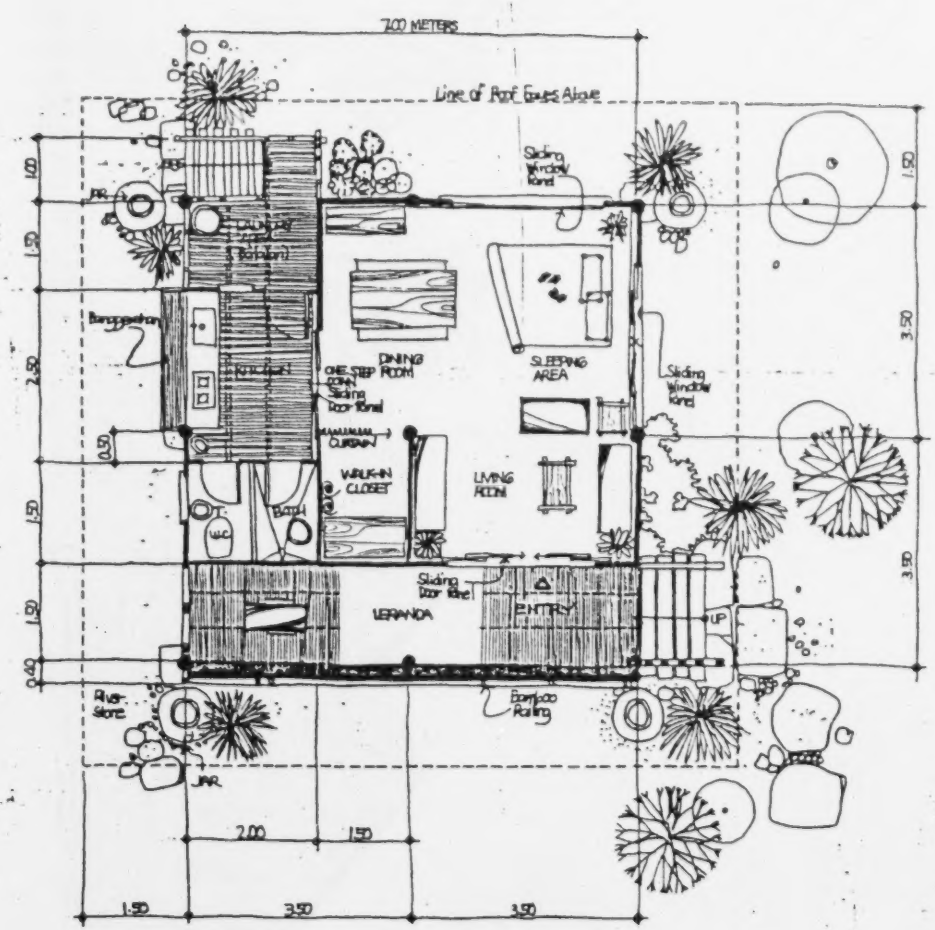
SCALE 1:100M.
TOTAL FLOOR AREA 44.75 S.M

MATERIALS USED

I STRUCTURAL
- a. FOOTING - CONCRETE PIER
- b. COLUMN - COCONUT TRUNKS
- c. GIRDER - COCONUT TRUNKS
- d. TRUSSES/RAFTERS - BAMBOO
- e. ROOFING - NIPA & BAMBOO

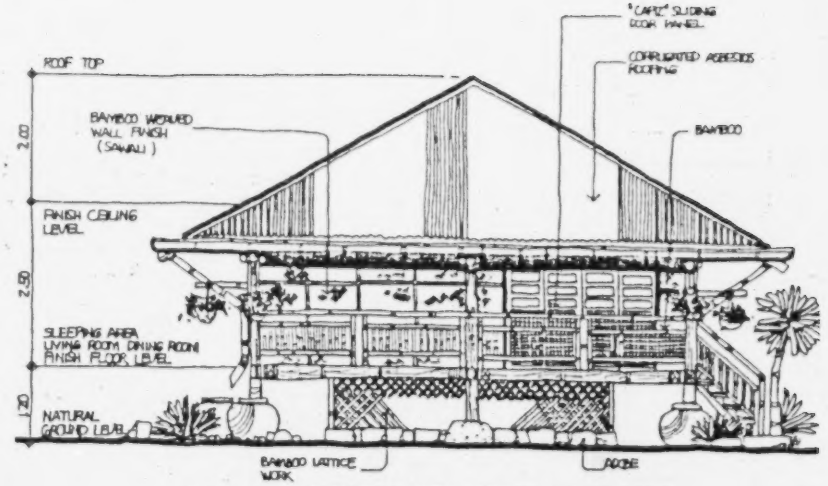
II FINISHES
- a. EXTERIOR WALL - BAMBOO
- b. INTERIOR PARTITION - BANIG, FINE WEAVED SAWALI, OR VISAYAN CLOTH

III DOOR & WINDOW
- a. DOOR - FINE WEAVED SAWALI ON WOOD FRAME WITH BAMBOO CLIPPINGS
- b. WINDOW - CAPIZ SHELL ON WOOD FRAME



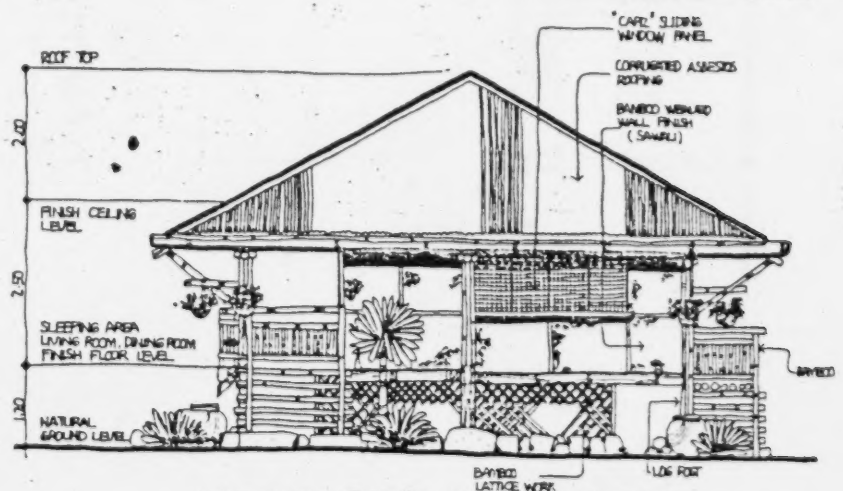
FLOOR PLAN

SCALE 1:50 METERS



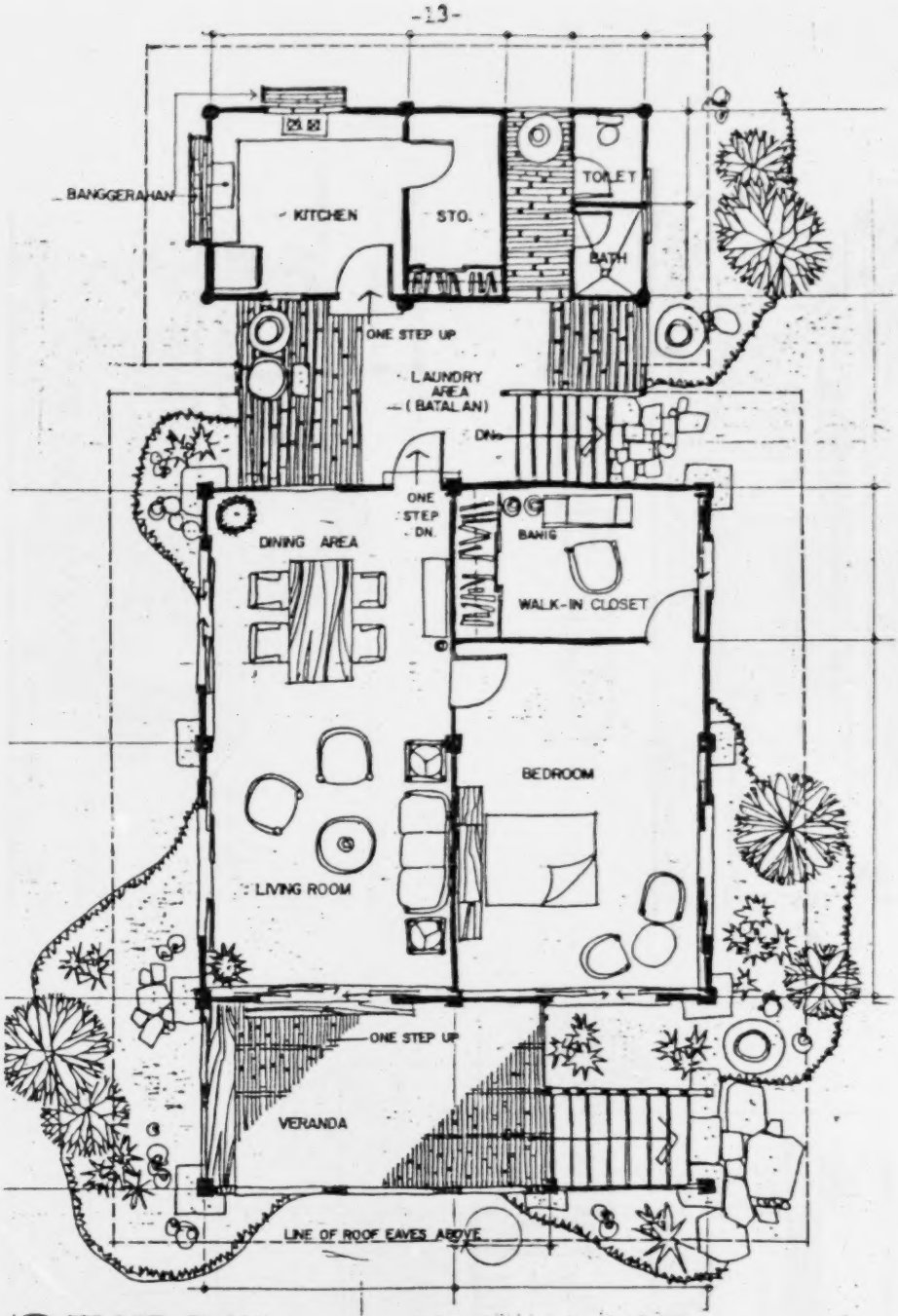
FRONT ELEVATION

SCALE 1:50 METERS

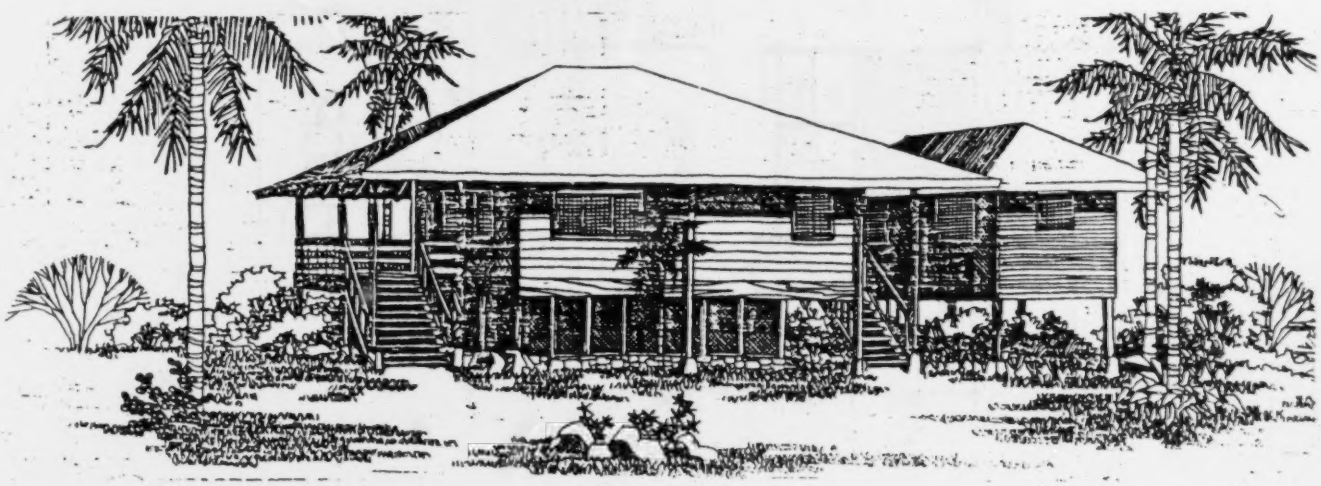


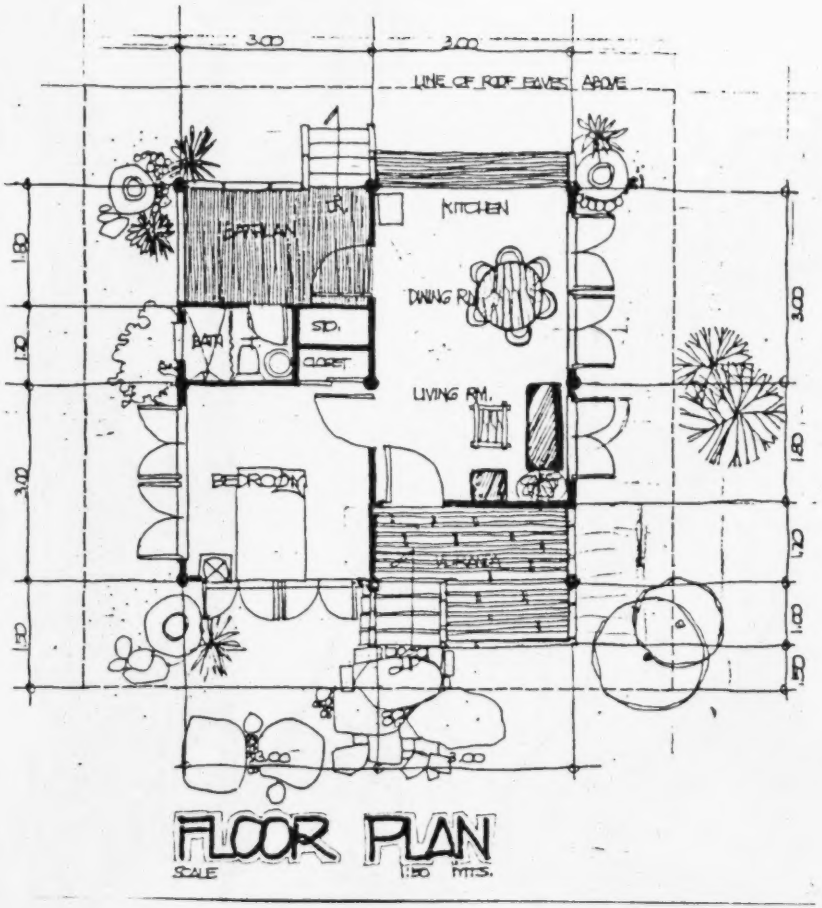
RIGHT-SIDE ELEVATION

SCALE 1:50 METERS



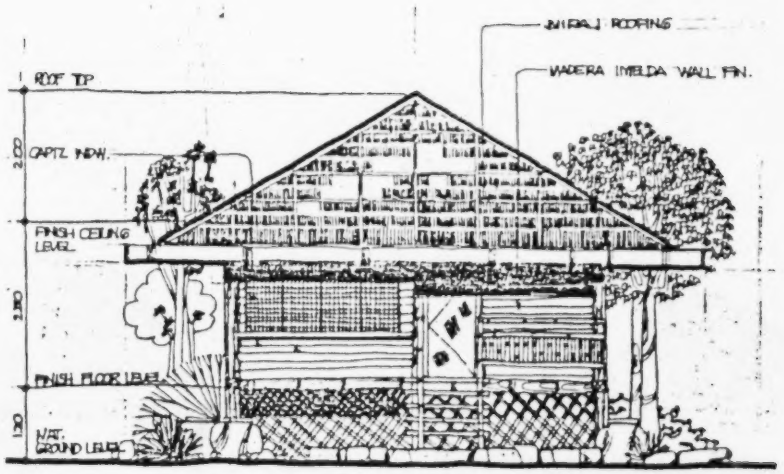
FLOOR PLAN SCALE 1:50 m.





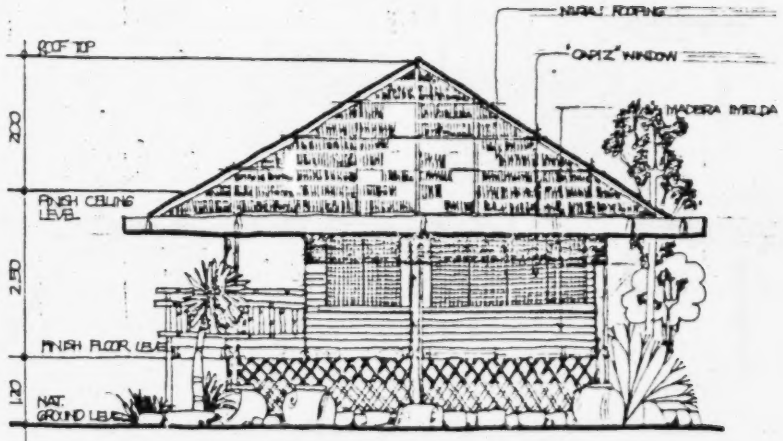
FLOOR PLAN

SCALE 1:50 MTS.



FRONT ELEVATION

SCALE 1:50 MTS.



RIGHT SIDE ELEVATION

SCALE 1:50 MTS.

DESIGN CONCEPT: TO DESIGN A HOUSE FOR FAMILIES WHOSE ONLY SOURCE OF LIVEHOOD IS FISHING - MAKING THE STRUCTURE AS AFFORDABLE AS POSSIBLE BY ASKING ONLY TO PAY A CERTAIN WEIGHT OF FISH DAILY AS AMORTIZATION

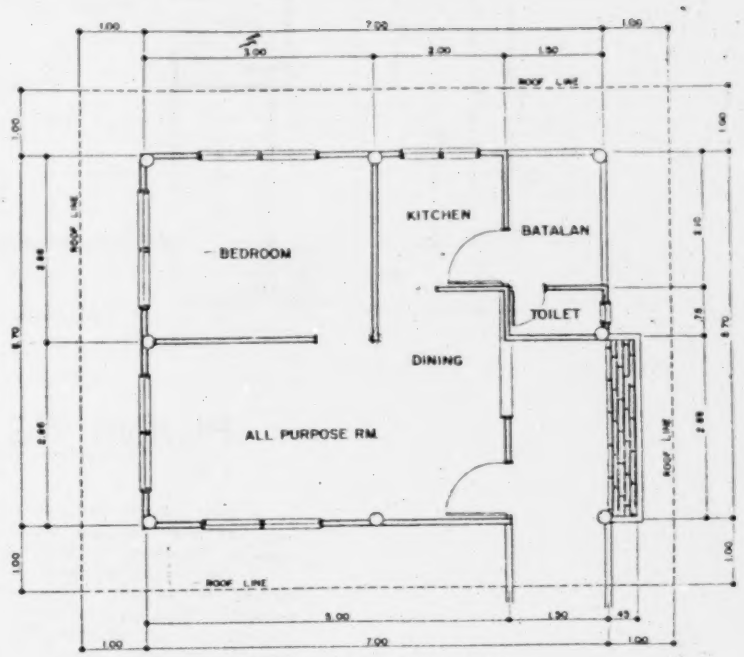
MATERIALS USED: NIPA, MADERA IMELDA, BAMBOO, TREATED LOG, MAT & LUMBER
OTHER SIGNIFICANT INFORMATION:

ONE BEDROOM HOUSE

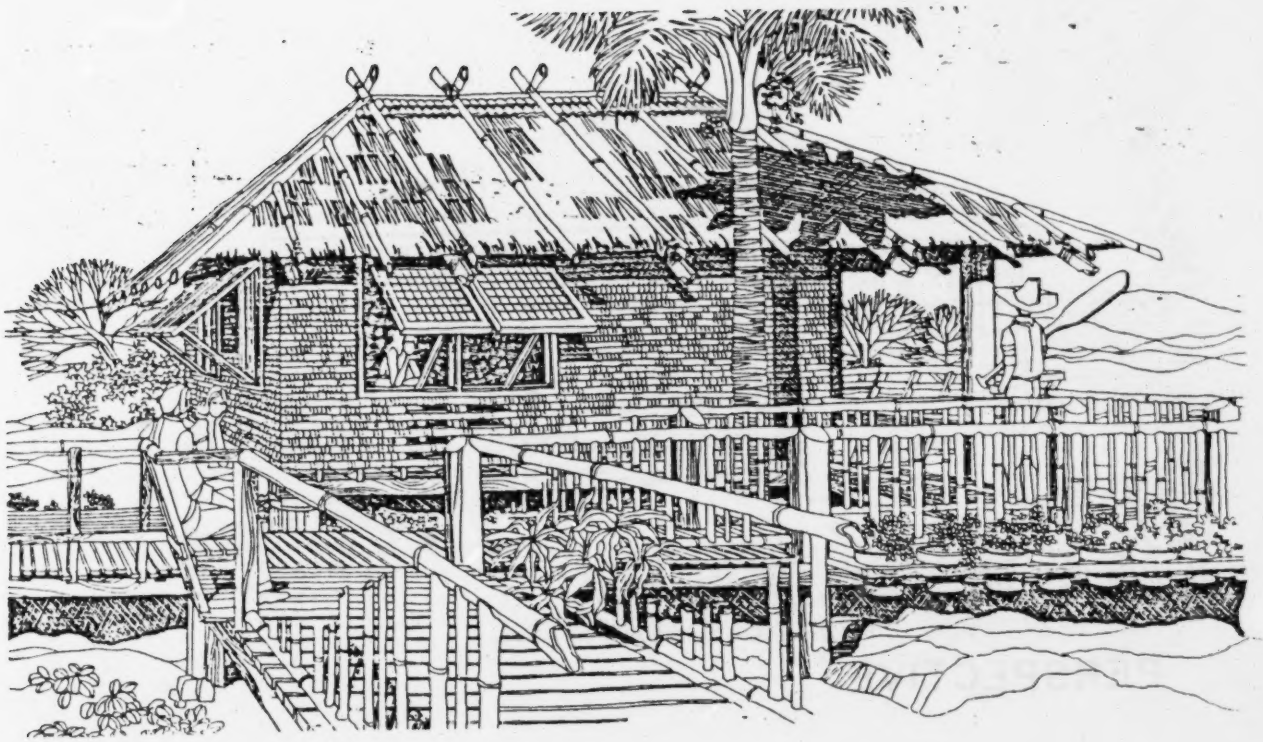
HOUSES ARE BUILT ON STILTS, IN CLUSTERS OF 8-UNITS EACH, AND JOINED BY STURDY CATWALKS.

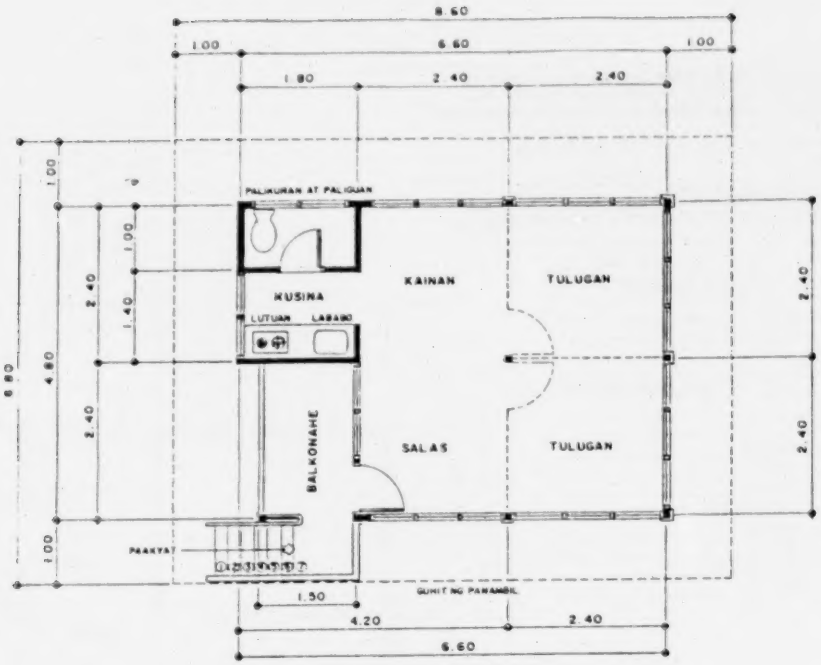
AREAS	
ALL PURPOSE ROOM	15.75 SQUARE METERS
BEDROOM	8.55
KITCHEN	4.20
BATALAN/ TOILET	4.275
CATWALK	4.275
TOTAL FLOOR AREA	37.05 SQUARE METERS

SPECIFICATION OF MATERIALS		
1.00	NIPA	ROOFING
2.00	MADERA IMELDA	SIDING
3.00	TANGUILE LUMBER	FLOORING
4.00	APITONG LUMBER	ROOF & FLOOR FRAMES
5.00	POURED CONC.	FOOTING
6.00	LOG	POST
7.00	BAMBOO	RAILINGS & ETC
SITE	TADLAK, LAGUNA	1979



FLOOR PLAN

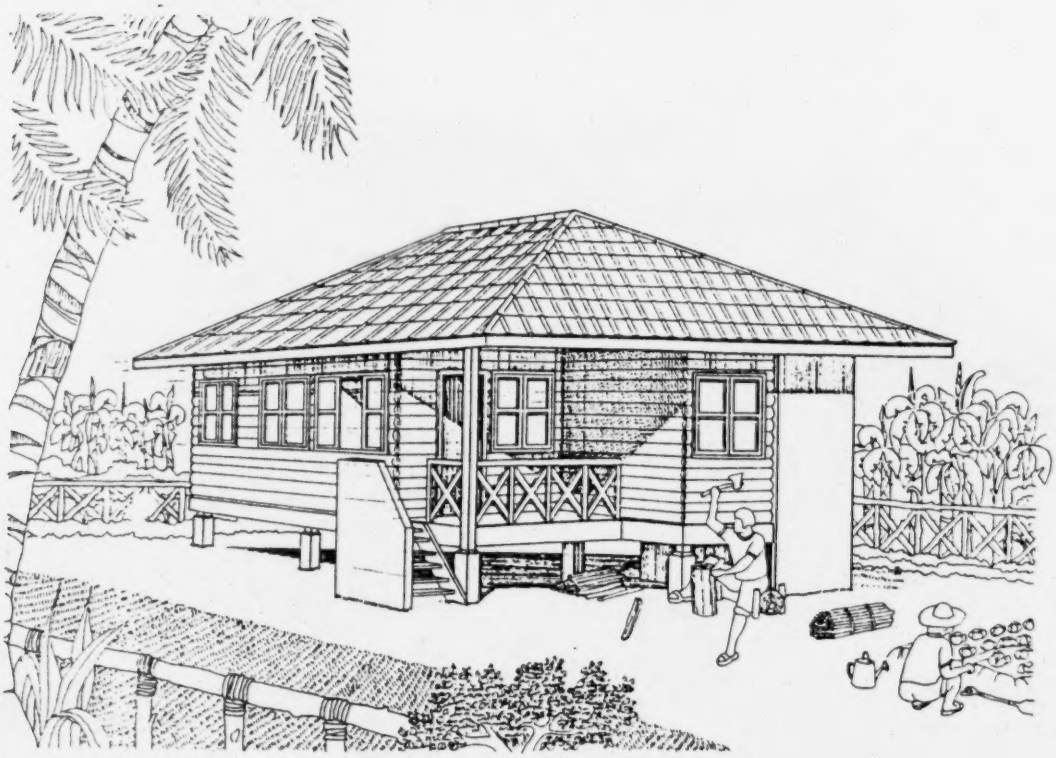




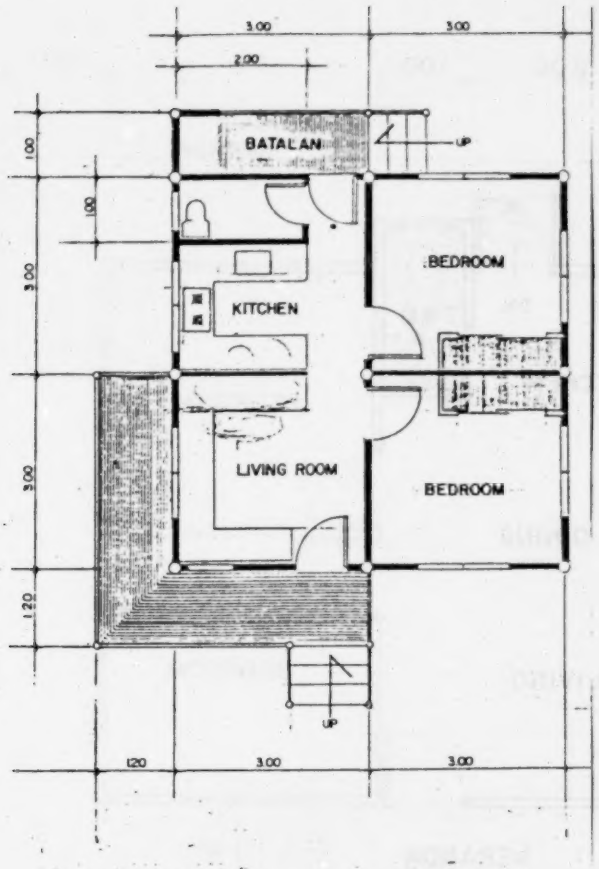
PLANO NG PALAPAG

ESKALA 1 : 50 METROS

THIS SINGLE - DETACHED HOUSE IS 32 SQ. MTS. IN AREA AND HAS THE FOLLOWING ELEMENTS: BALCONY, LIVING/DINING - ROOM, 2 BEDROOMS, KITCHEN AND TOILET AND BATH. THE WALLS ARE MADE OF "HALF - MOON" WHICH IS A BY-PRODUCT OF PLYWOOD. THE ROOF IS MADE OF ASBESTOS TILES STRONGLY FASTENED TO RESIST STRONG WINDS IN MONSOON - FREQUENTED REGIONS AND THE FLOOR LINE IS ELEVATED TO PREVENT THE QUICK ONRUSH OF WATER INTO THE DWELLING.



PERSPECTIVE



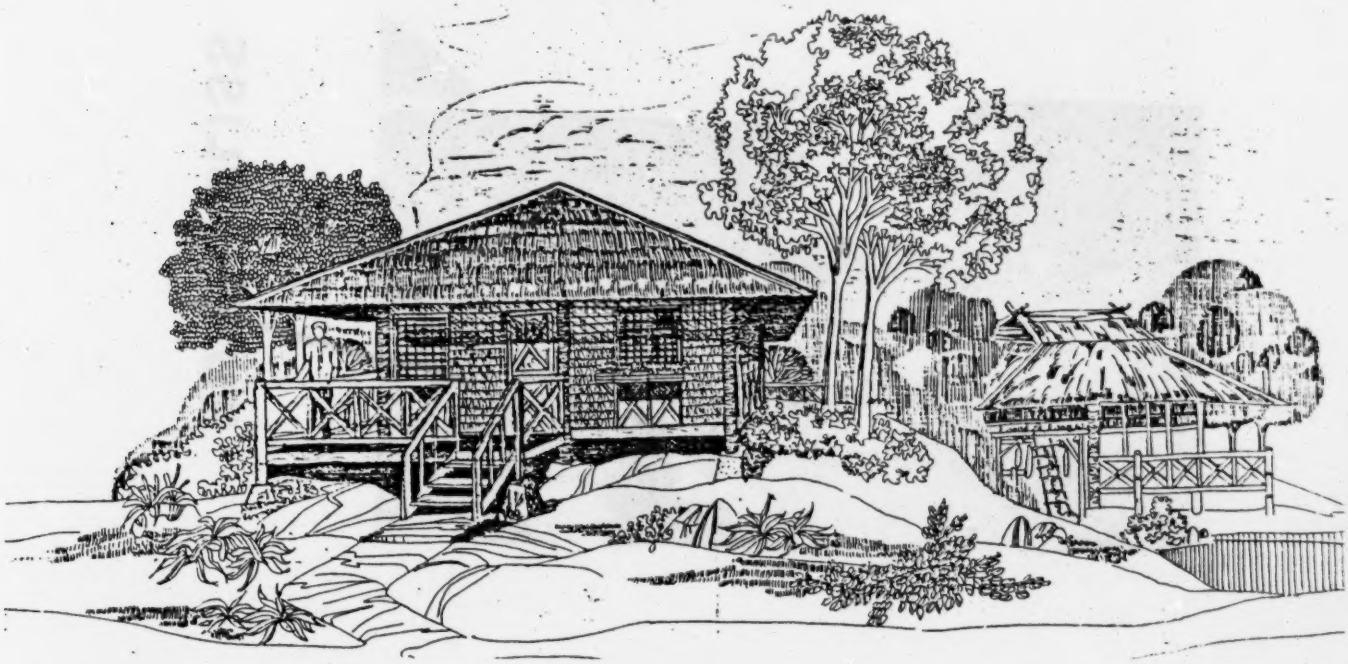
MADERA IMELDA:
VERTICAL POST SUPPORT ARE MADE OF MADERA IMELDA (REINFORCED COCONUT TRUNK)

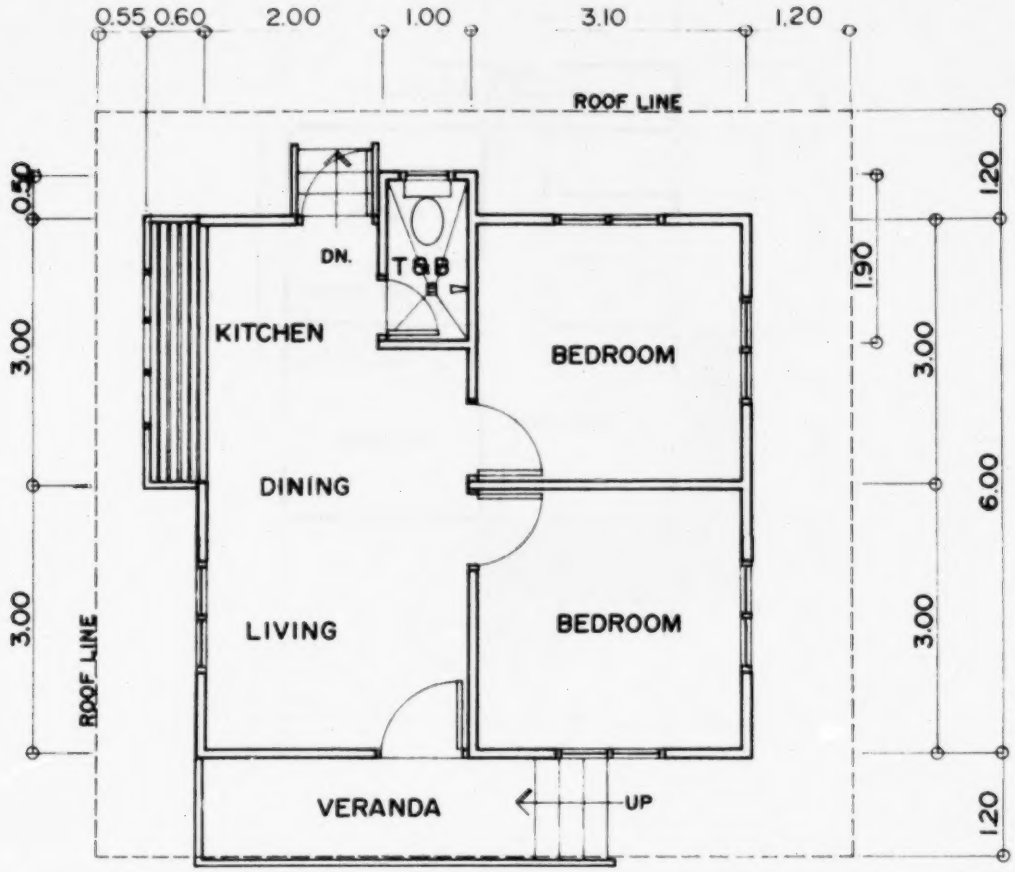
FLOORING:
FLOORING MATERIALS ARE MADE OF FLOOR JOIST W/ T&G FLOORING EXCEPT FOR "BATALAN" & NATIVE BALCONY WHICH ARE MADE OF SPLIT BAMBOOS FOR ITS FLOOR FIN.

WINDOWS & DOORS:
WINDOWS ARE MADE OF SLIDING CAPIZ AND DOORS FLUSHED WITH WOODEN PSS.

EXTERIOR WALL FINISHED:
EXTERIOR WALL FINISHES ARE MADE OF MADERA IMELDA (CHOPPED)

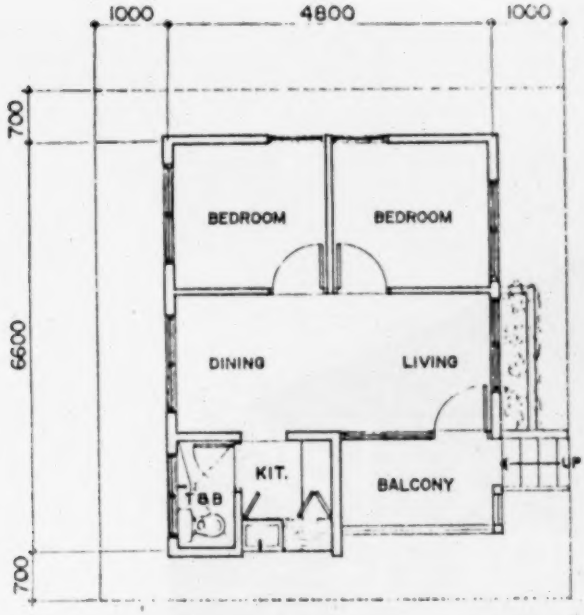
ROOFING MATERIALS:
THE ROOF IS MADE OF COCO SHINGLES AND LAID ON T&G NAILERS





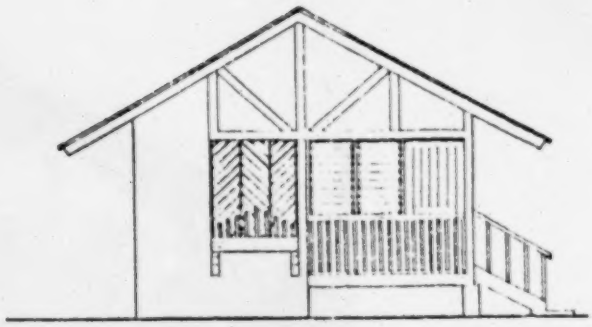
FLOOR PLAN
SCALE: 1:75

RURAL BLISS

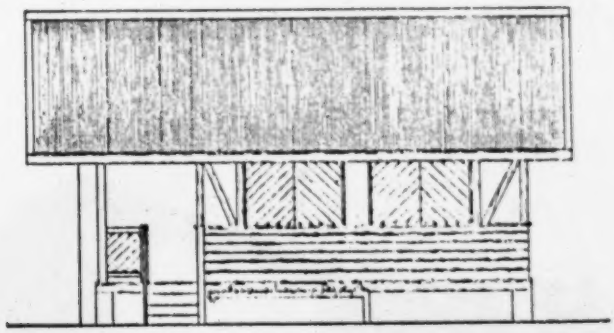


FLOOR PLAN

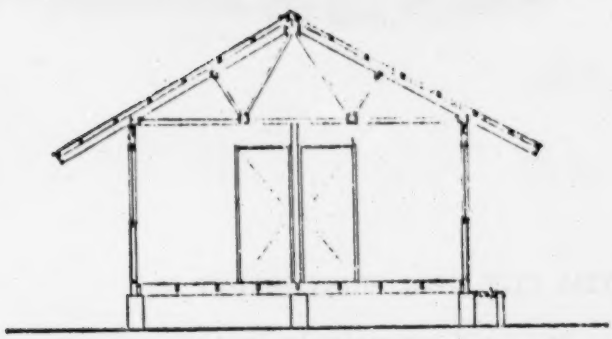
10 05 0 10 20M.



FRONT ELEVATION



RIGHT SIDE ELEVATION

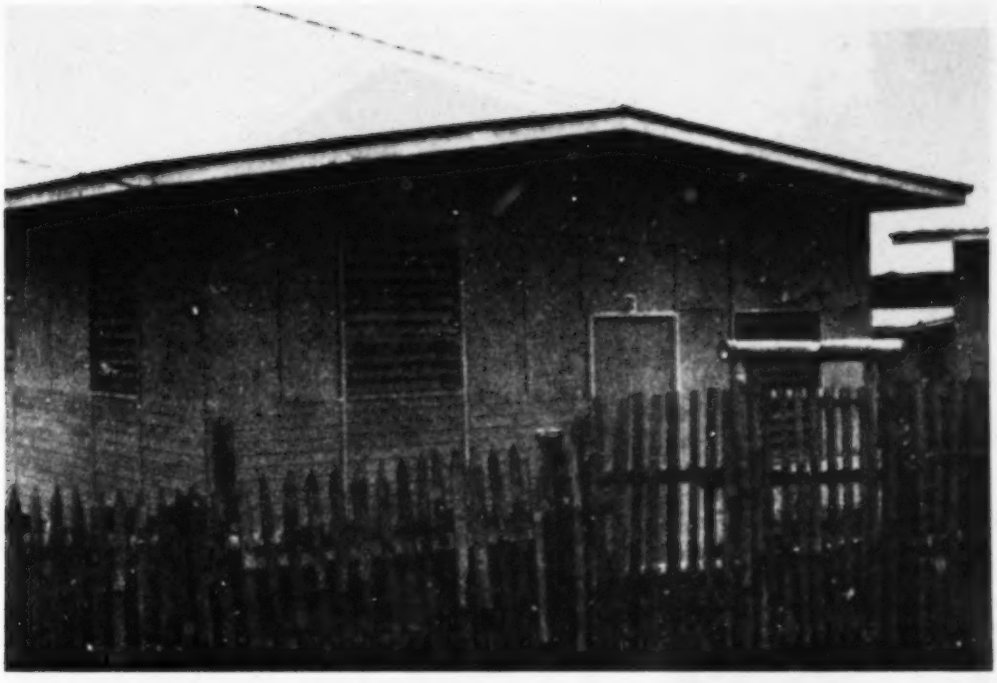


CROSS SECTION

RURAL BLISS

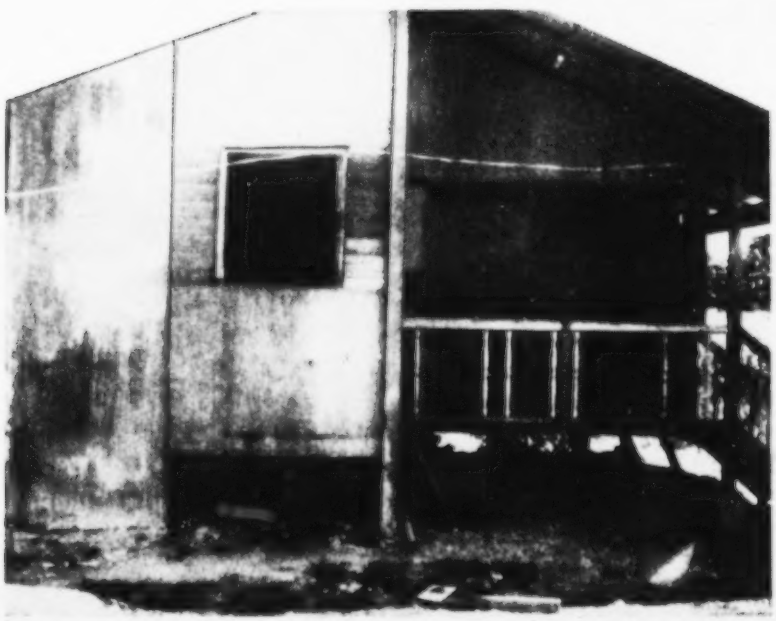
TAGAYTAY CITY RURAL BLISS PROJECT

Timber was used extensively in this project.
Except for the toilet and bath the rest of the house is of timber.



RURAL BLISS HOUSES

Traditional and indigenous materials have been replaced with more durable and more lasting materials such as corrugated galvanized iron, asbestos sheets plywood and concrete hollow blocks.



RURAL BLISS HOUSES

Modified "Bahay Kubo" constructed with modern materials - - timber in place of bamboo for the structural frame, hardboard and wood for wall sidings, and corrugated galvanized iron sheet in place of tatched roof.

FLEXIHOMES PROGRAM

Prior to 1982 public urban housing as implemented under the Urban BLISS Program were mostly 4-storey concrete walk-up structures. This type of housing was generally costlier than single or two storey housing and also took a longer time to construct. In addition, in most parts of the country the long monsoon season limits the construction season anywhere from seven to nine months. There was and there still remains a need to speed up construction and delivery of dwelling units to cope with the demands of a growing population.

Also in 1982 most of the plants manufacturing construction materials were not operating at their rated capacity because of the slump in construction activities. This contributed greatly to the soaring of construction material prices. While the National Livelihood Program (also implemented by the Ministry of Human Settlements) was taking shape, ironically, small manufacturing enterprises (wood working and hollow block making) were closing permanently due to lack of business.

Confronted with the problem of delivering houses at a fast turnover and providing livelihood opportunities to the unemployed, shelter component fabrication appeared to be an answer. The idea was to fabricate and stockpile standard components such as doors, windows and wall panels throughout the nation so that these are readily available all year round.

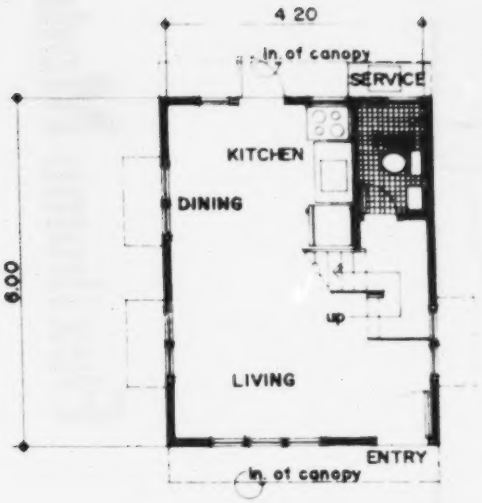
Thus, the Flexihomes Models Program was initiated. As a shelter program strategy, it may be viewed as the first stage toward achieving an industrialized shelter construction system and the standardization of building materials and components.

The initial exercise was to prepare house plans and designs in modules that would accommodate as much of the various materials commonly used in shelter construction already available in the market and eventually, to prefabricate building components.

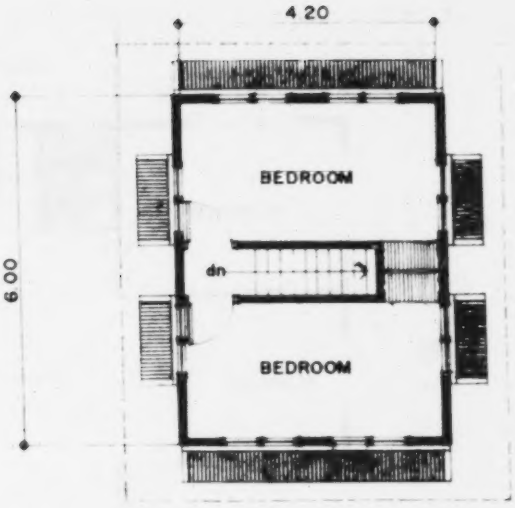
The designs had to be flexible enough so as to be adaptable to various configurations (detached, duplex, or semi detached and row-house). Flexibility in design also necessitated the possibility of adopting a conventional or prefabricated system in traditional or new materials. Furthermore, designs were required to reflect the architectural character of traditional Filipino houses. With panels and components coming in a number of variations in architectural treatment and finishes (in uniform dimensions), varied exterior designs may be achieved.

The first three models designed and constructed were, namely: FM 50.4, FM 77.7, and FM 60.4. These have been inspired by the "bahay na bato" where the ground floor is of concrete and the upper floor of timber. Design motifs bear a resemblance to the traditional houses. The succeeding pages illustrate the three models mentioned and the various design motifs.

Flexihome Model



GROUND FLOOR PLAN

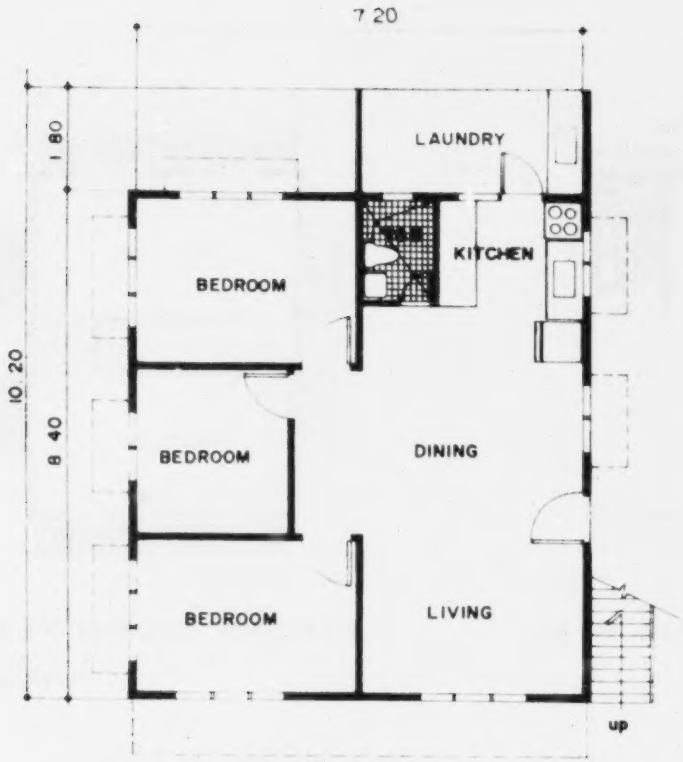


SECOND FLOOR PLAN

0 100 200

FM 50.4

Flexihome Models

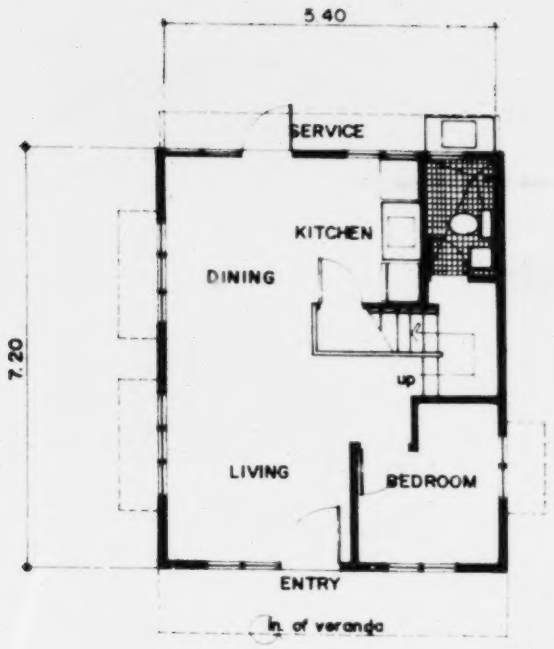


FLOOR PLAN

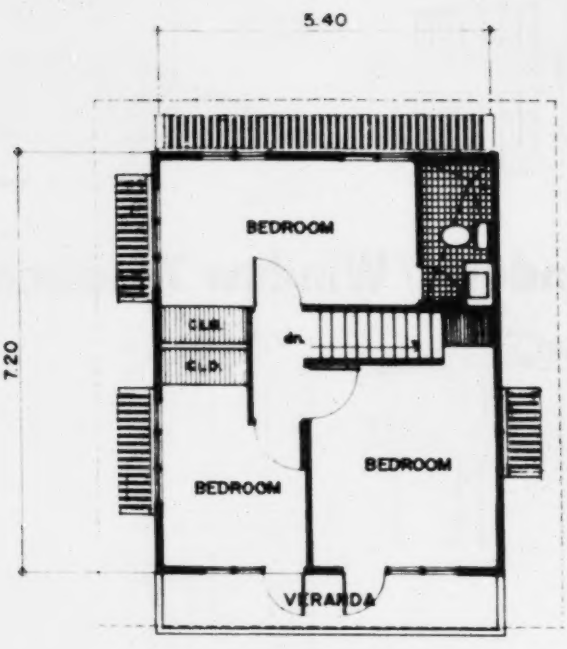
0 1.00 2.00

FM 60.4

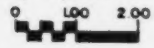
Flexihome Model



GROUND FLOOR PLAN

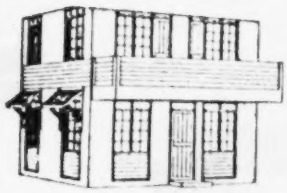


SECOND FLOOR PLAN

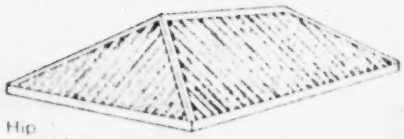


FM 77.7

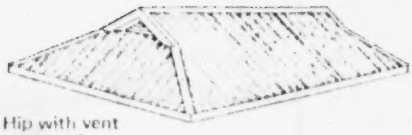
Roofs



Gable
GB 101

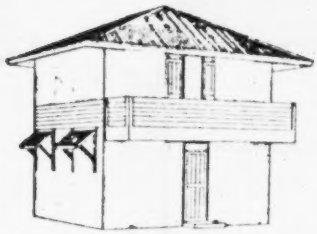


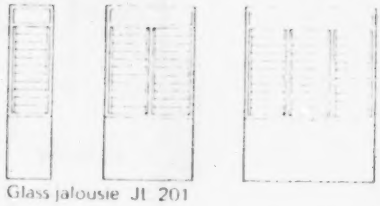
Hip
HR 102



Hip with vent
VHR 103

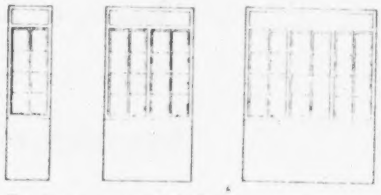
Windows/Window Treatments



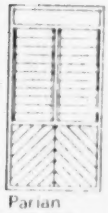


Glass jalousie JL 201

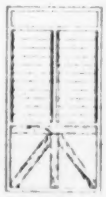
Wood casement WL 202



Steel casement SC 203



Parian
WT 301

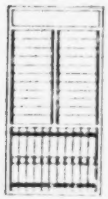


Real
WT 302

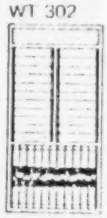
Santiago
WT 303

Sn Ignacio
WT 304

Sn Agustin
WT 305

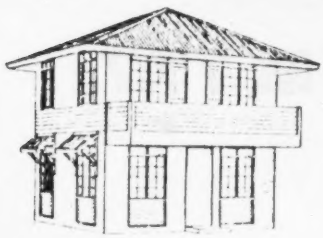


Sta. Clara
WT 306



Sn Gabriel
WT 307

Entrance Doors



4 sections
ED 701

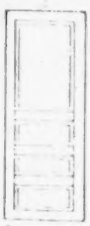
Vertical
ED 702

Diagonal
ED 703

A frame
ED 704

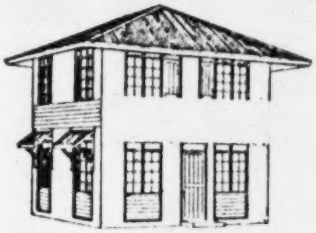
2 sections
ED 705

8 sections
ED 706



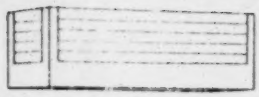
4 unequal
ED 707

Verandas

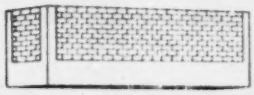


Parian V 401

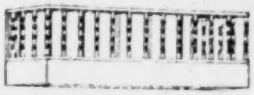
Real V 402



Santiago V 403



Sn Ignacio V 404

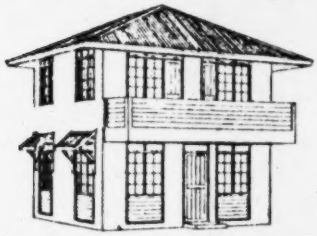


Sn Agustin V 405

Sta Clara V 406

Sn Gabriel V 407

Wall Sidings

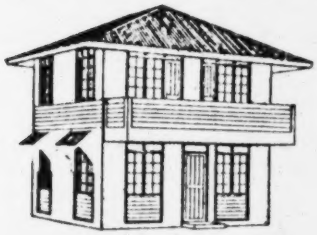


Santiago WS 501

Sn Agustin WS 502

Sn Ignacio WS 503

Canopy Braces



Sta. Ana
CB 601

Makati
CB 602

Quiapo
CB 603

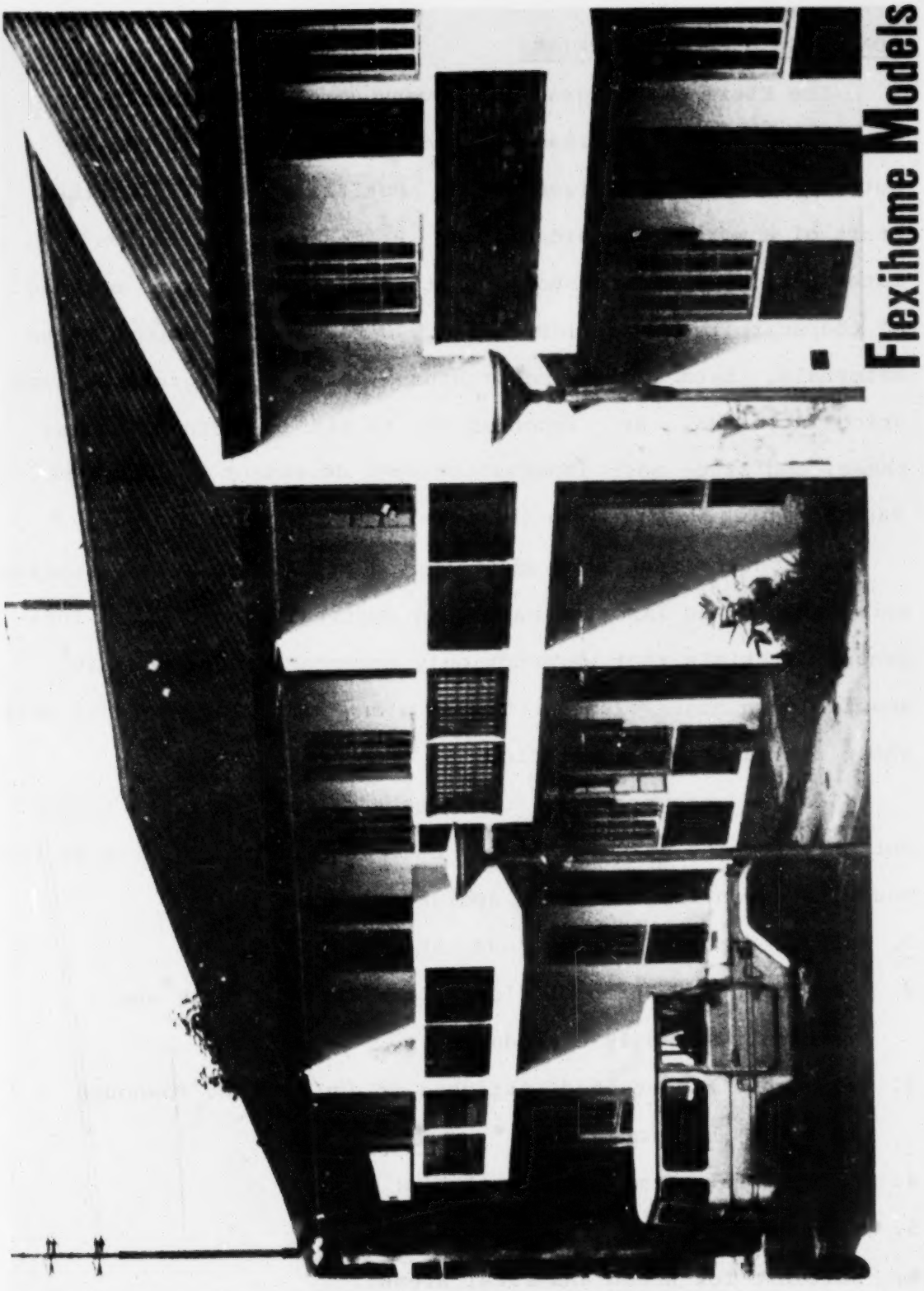
Binondo
CB 604

Sn Miguel
CB 605

Intramuros
CB 606

Ermita
CB 607

Flexihome Models


Flexihome Models

ADAPTING TO ECONOMIC CRISES

The Flexihome Program had a very good start. Not only were these dwelling units constructed in Metroplitan Manila but also in less urbanized areas. But the year 1983 was the start of a worse economic crisis. Prices of construction materials continued to shoot up at even a greater rate because of the scarcity of foreign currency with which to import these materials. Even locally manufactured materials registered high price increases, as imported oil is also used in producing these, and since most importation were dependent on borrowed capital which was tied to the foreign exchange rate.

But rather than stop shelter production altogether, studies were made to use imported materials sparingly and utilize indigenous materials that were not only acceptable, but readily available in huge volumes. Timber along with clay products were among the materials identified.

Designs were prepared for homes that would utilize timber not only for the main framework but also for other parts of the house based on the following design criteria:

1. efficient use of indigenous materials;
2. maximum utilization of floor space (horizontally and vertically) easily expandable;
3. adoptable to detached, attached or duplex, and rowhouse (terrace) housing;
4. affordable and market acceptable;
5. acceptable for mortgaging;
6. suitable for urban and rural areas;
7. reflective of Filipino culture and traditions.

Once again turning to the traditional houses for inspiration, schemes developed by the architects were variations of the house on stilts ("bahay kubo") or a combination of concrete hollow blocks and timber as in the traditional bahay na bato.

FLEXIHOME MODEL 40.32

Appearing more of a gambrel roof on stilts, this design which attempts to make use of the space underneath the roof for daily activities, utilizes wood to the fullest. Plywood, being manufactured locally and even exported, was the material considered by the designers for this model. Dimensions of the dwelling unit and its components have been derived from the 4' x 8' (1.20 m. x 2.40 m.) plywood size.

The house measuring twelve feet (3.60 m) across by twenty feet (6.00 m) deep is raised from the ground on 6 inch (150 mm) load bearing concrete hollow block stilts reinforced with 12 mm bars. The close spacing of the posts permitted the use of lesser timber framing resulting to a more economical solution. Timber floor joists spanning the longer length of the house are supported midway and at the end by these posts. Prefabricated floor panels (FP-1) measuring 8'-0" (2400 mm) x 5'-4" (1600 mm) provide the framing for the 1/2" (12 mm) plywood flooring. The framing is made of 2" x 2" (50 mm x 50 mm) hardwood spaced at 1'-4" (400 mm) on centers laid perpendicular to the floor joists with 1" x 2" (25 mm x 50 mm) diagonal bridging.

Rafters framing the roof are 2" x 6" (50 mm x 150 mm), with the steeper slope spanning 6 feet (1.8 M). Half-inch plywood gusset plates join the rafters together at the ridge and at points where the slope changes. The bottom of the rafter is connected to the joist with plywood gusset plates too. Roof panels (RP-1 & RP-2) and wall panels which are similar in construction to the floor panels provide the framing for the 1/2" x 4' x 8' (12 mm) plywood skin.

Where the rafters meet the floor joists are wood slats to provide additional ventilation.

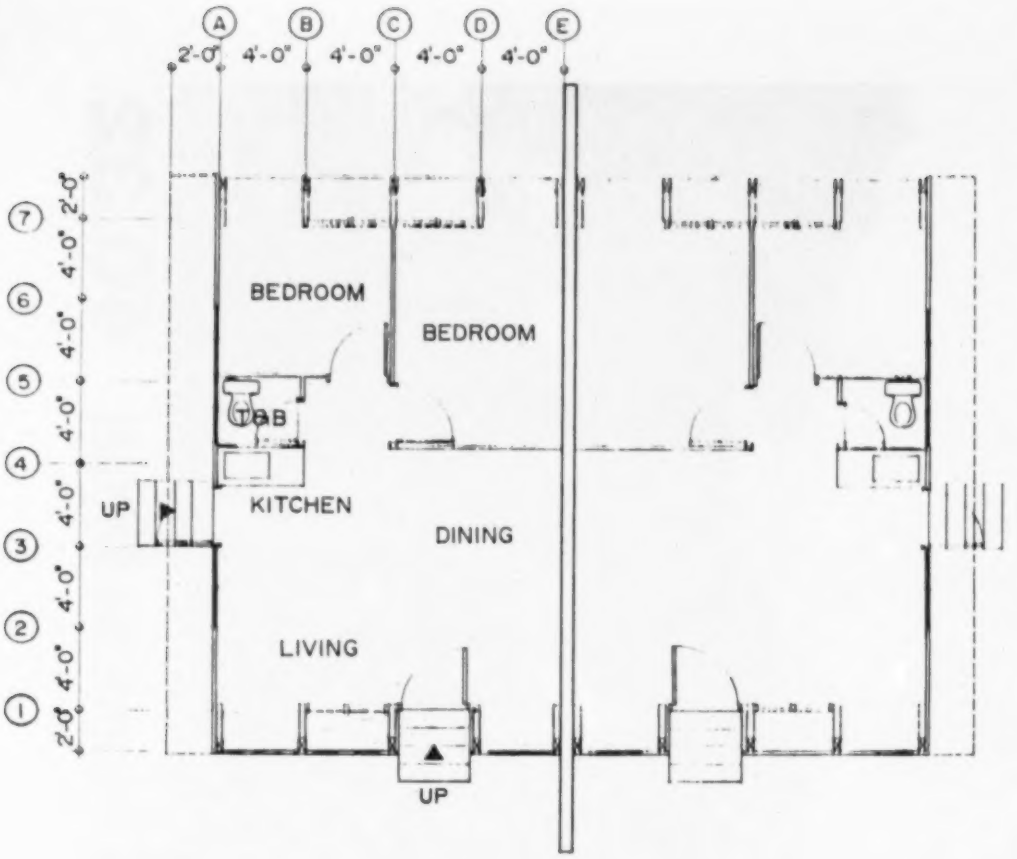
The possibility for additional expansion at ground level is one positive factor of this model.

Although this model offers the maximum utilization of timber, providing an appropriate impervious covering for the plywood outer skin has yet to be solved satisfactorily. One material substantially cheaper than corrugated galvanized iron roofing tried on this model is preformed vinyl sheets. Asphalt shingles were also tried and appeared to perform well.

As this model is practically made of wood, market acceptance was very poor.

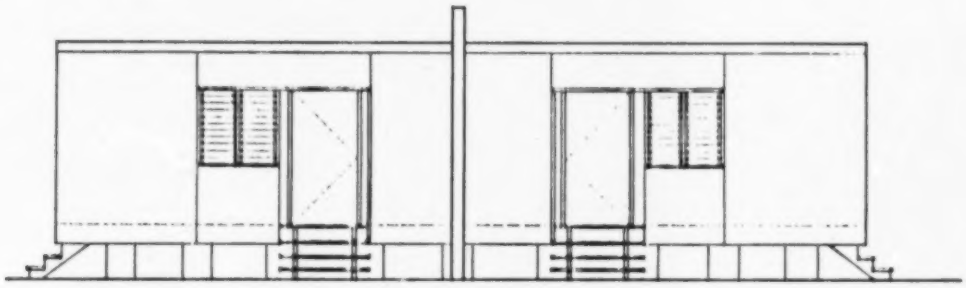
Flexihome Model 40.32

Flexihome Model 40.32

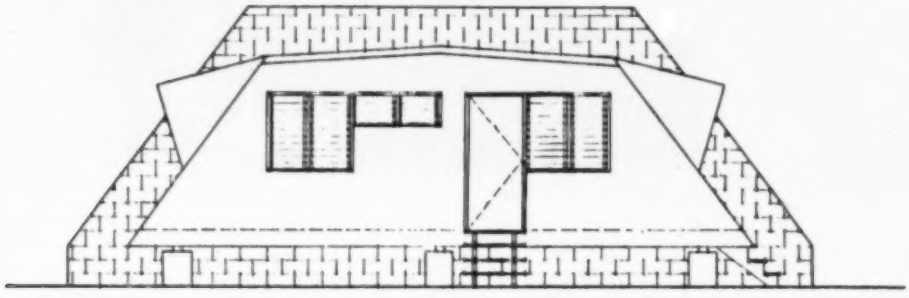


FLOOR PLAN

0 1 2 3 4 5 10 FEET

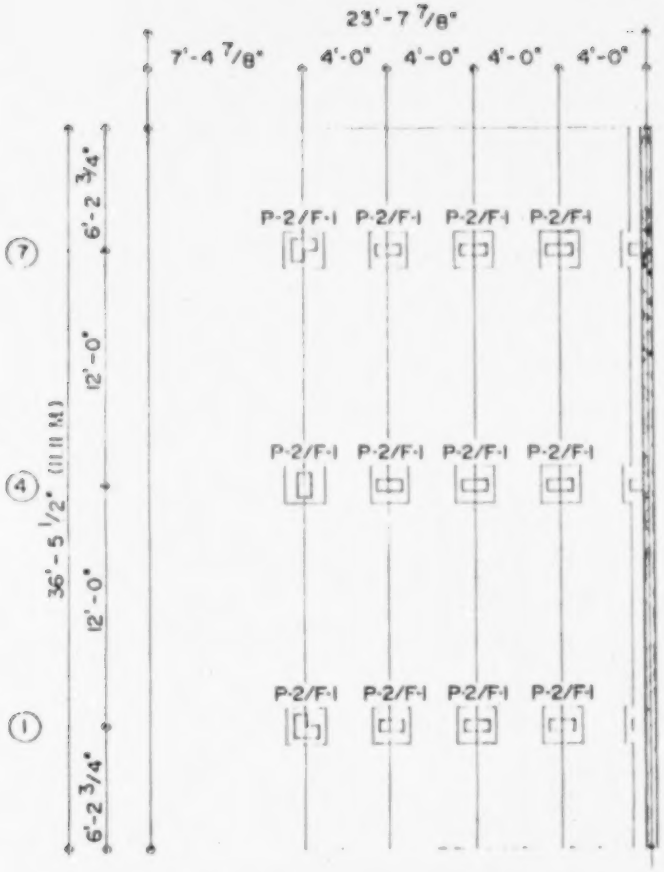


FRONT ELEVATION

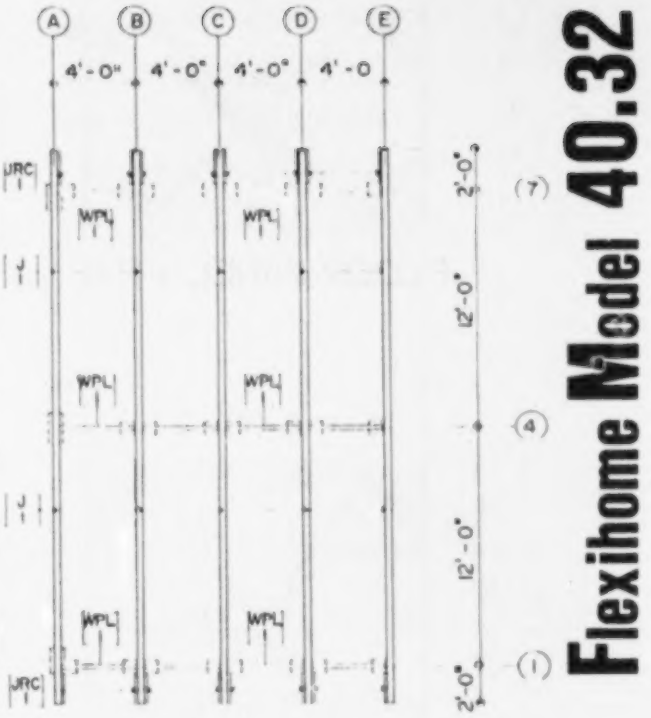


RIGHT SIDE ELEVATION

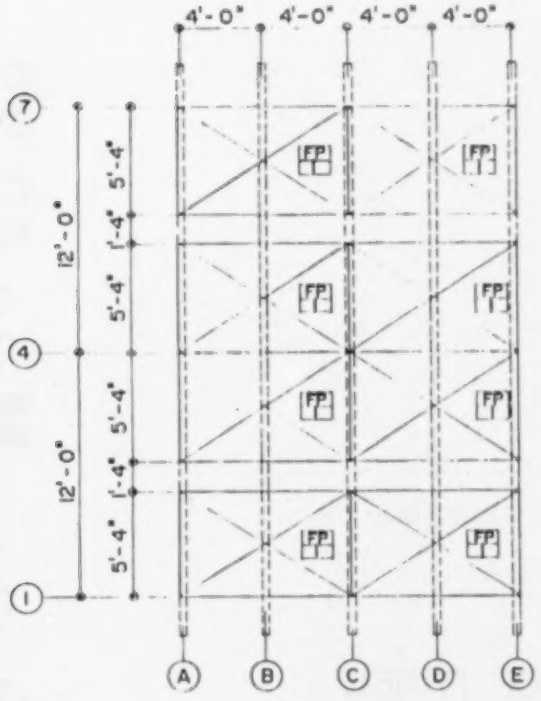
Flexihome Model 40.32



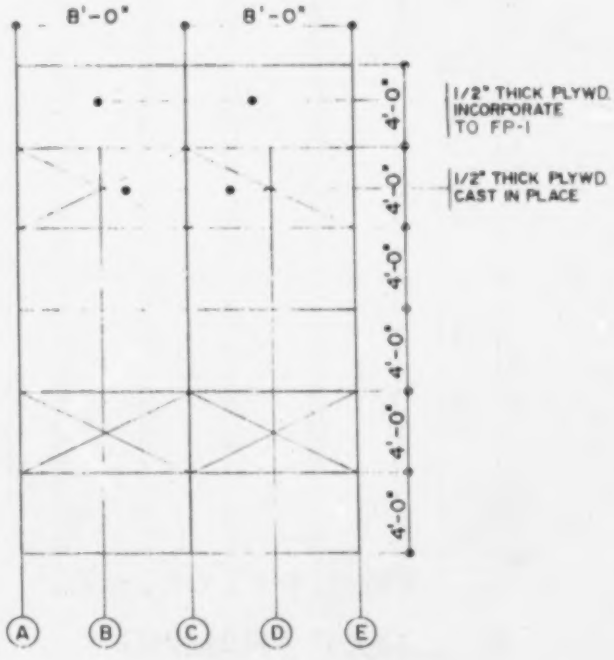
FOUNDATION PLAN



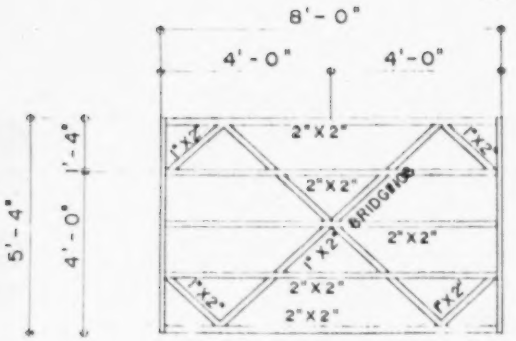
FLOOR FRAMING PLAN



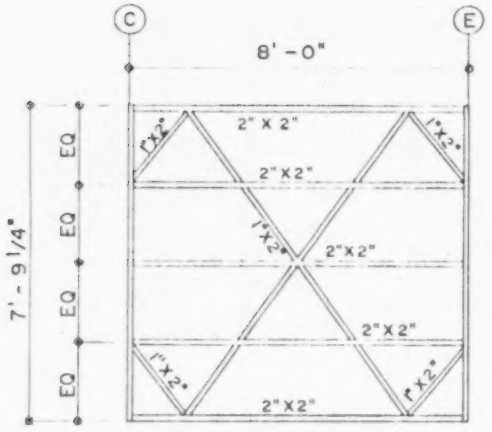
FLOOR PANEL LAYOUT



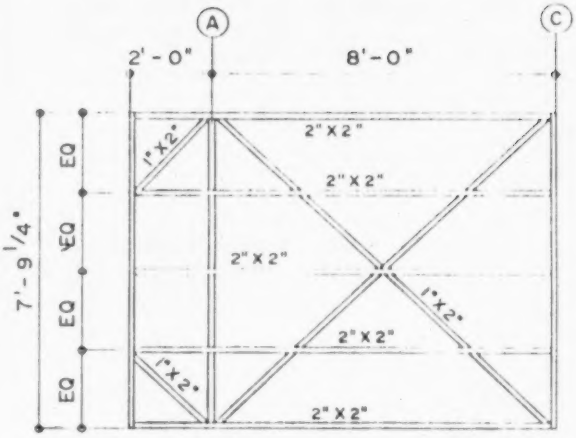
PLYWOOD FLOOR LAYOUT



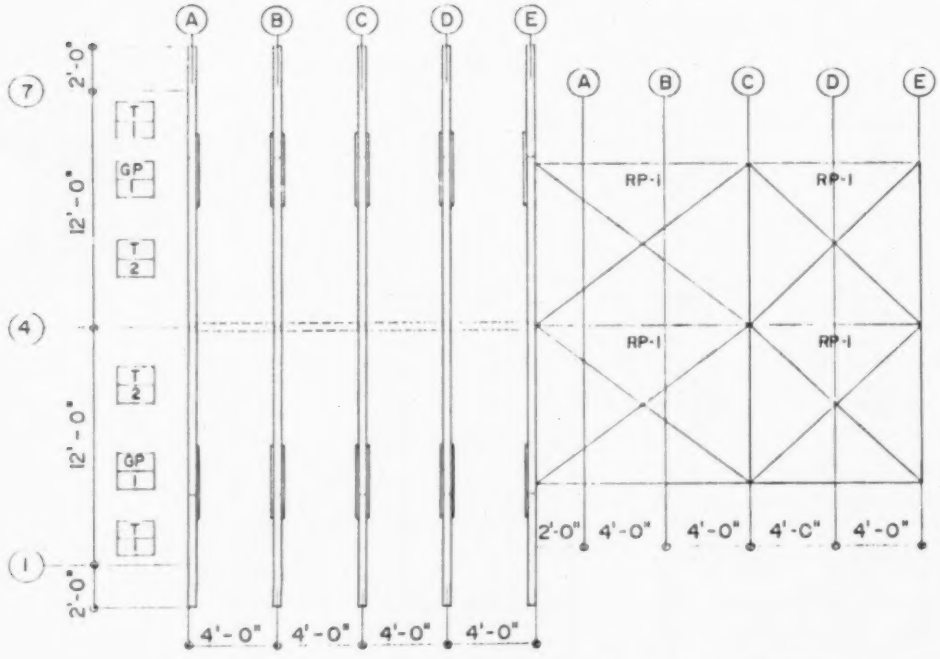
FLOOR PANEL FP-1



ROOF PANEL RP-1

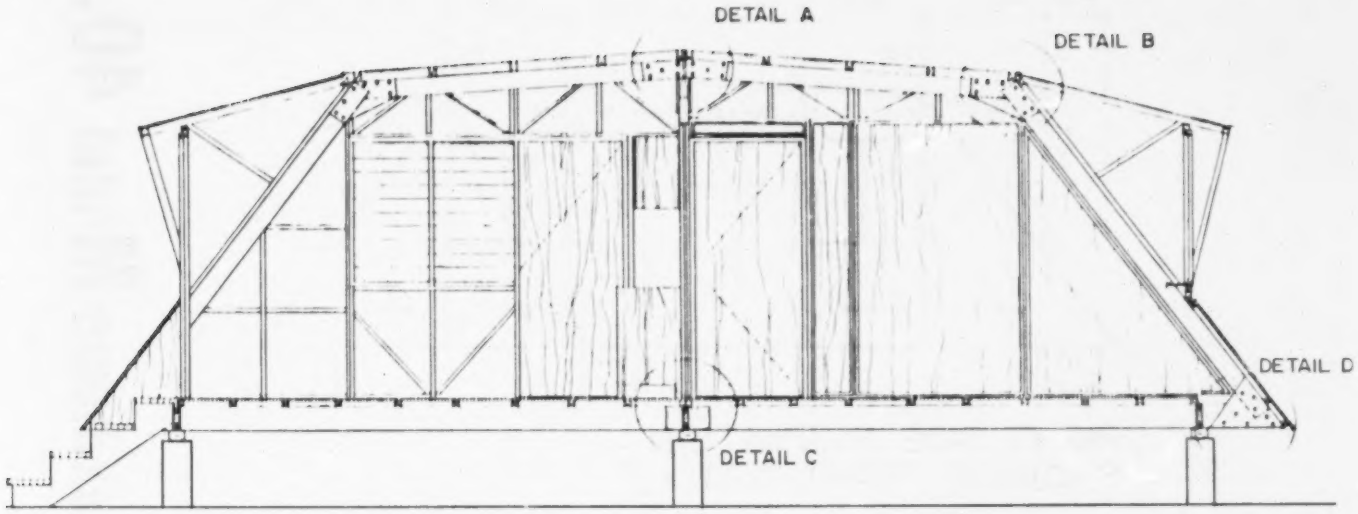


ROOF PANEL RP-1



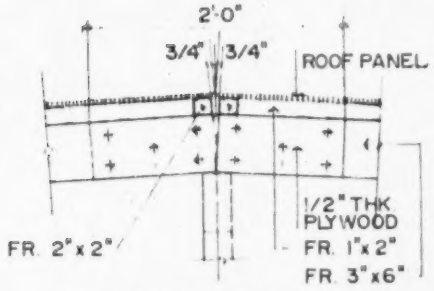
ROOF FRAMING ROOF PANEL

Flexihome Model 40.32

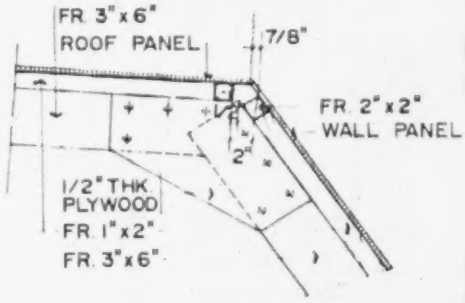


LONGITUDINAL SECTION

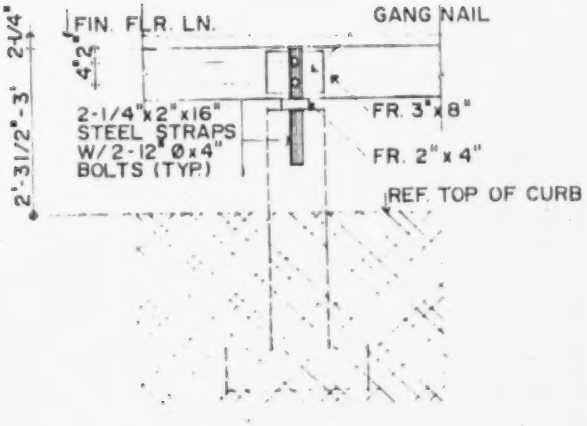
Flexihome Model 40.32



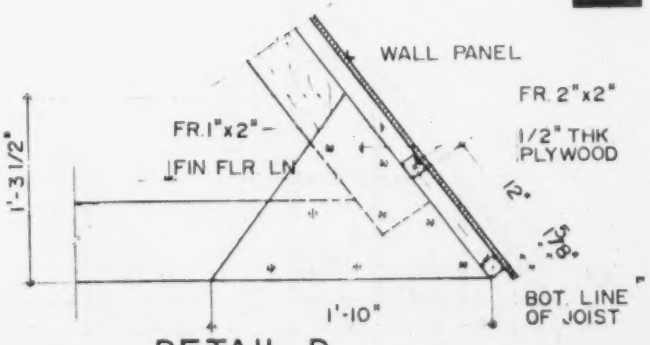
DETAIL A



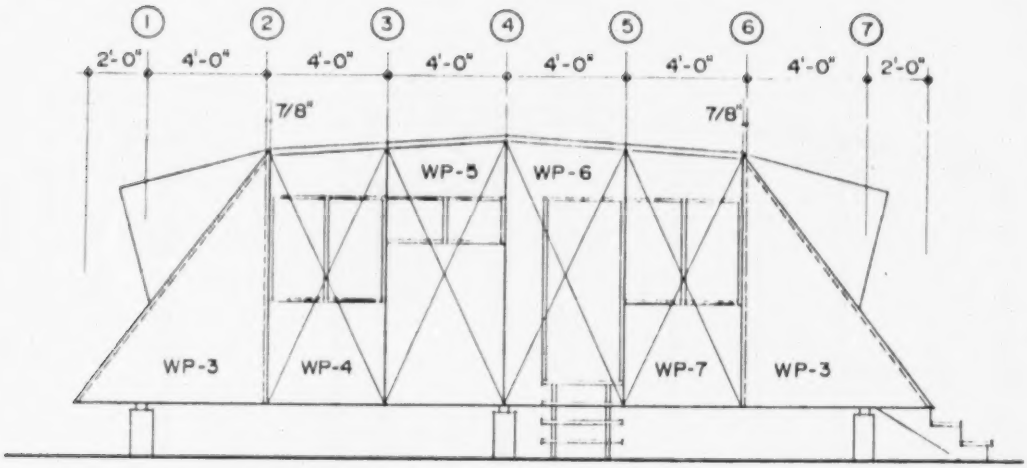
DETAIL B



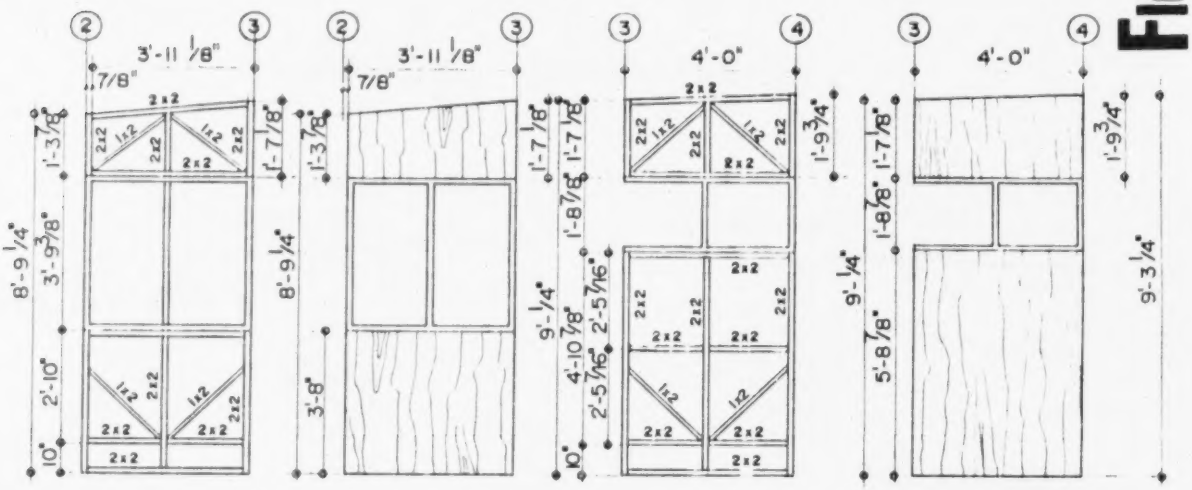
DETAIL C



DETAIL D



RIGHT SIDE ELEVATION
SHOWING PANEL LAYOUT

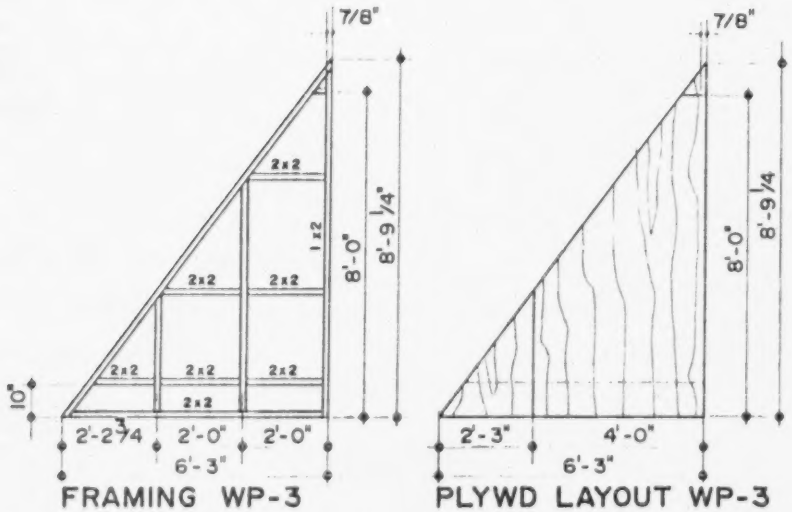


FRAMING WP-4

PLYWD LAYOUT WP-4

FRAMING WP-5

PLYWD LAYOUT WP-5



FRAMING WP-3

PLYWD LAYOUT WP-3

FLEXIHOME MODEL 46.8

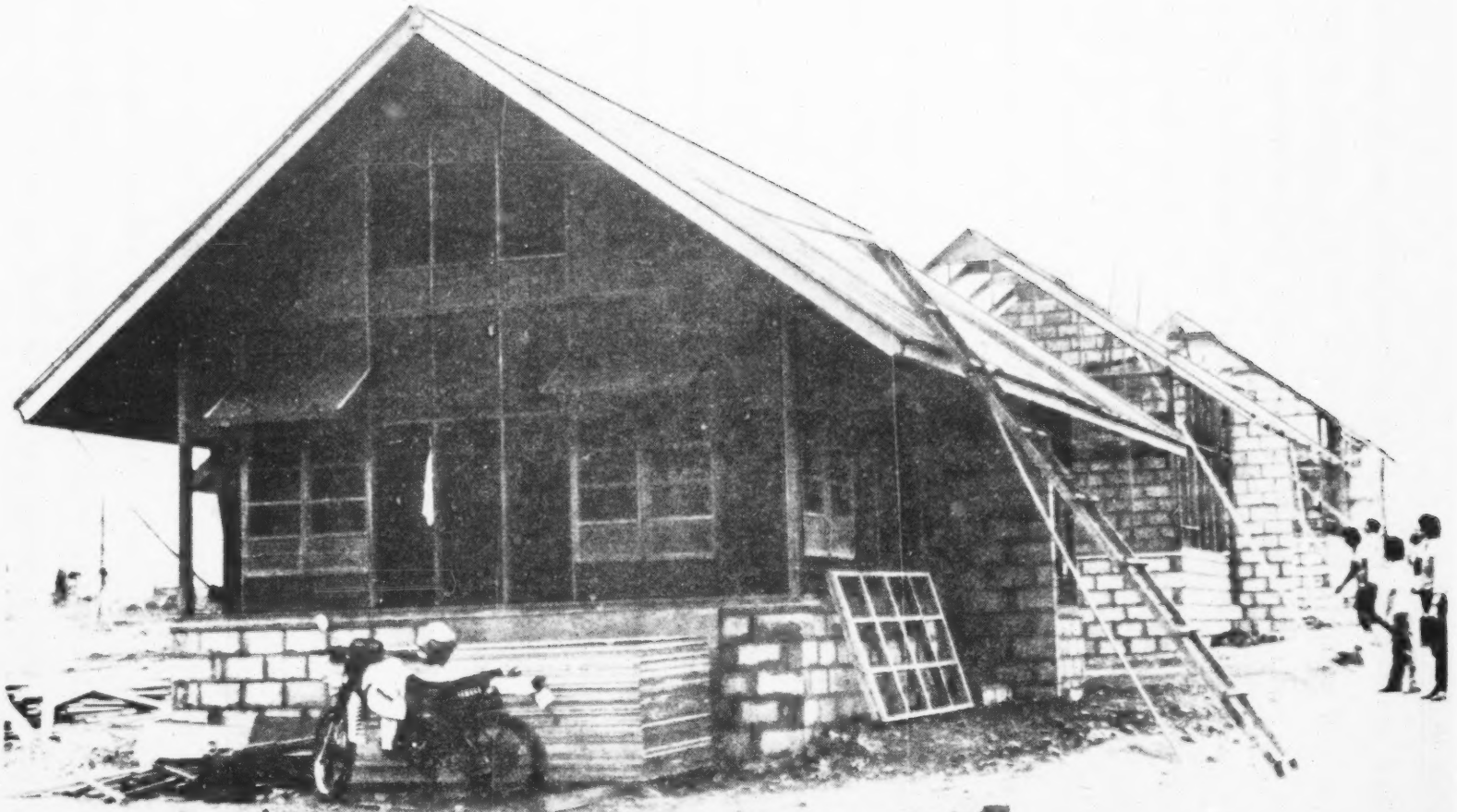
This is another model that attempts to use timber not only for its main framework but also for the exterior walls. As this is built directly on the ground (not elevated on stilts), it was deemed essential that the walls be of stone or concrete to gain market acceptance. To keep the cost down a compromise solution reached was to construct a concrete hollow block wall along the perimeter of the house up to the height of the window sill and build the rest of the house with timber.

Wall framing is made up of 50 mm x 75 mm studs spaced at 600 mm on centers. Framing for each face of the house is pre-fabricated and is bolted in place with anchor bolts. 50 mm x 150 mm joists spaced at 600 mm on centers are anchored to the studs. Similarly 50 mm x 75 mm rafters bear directly on the studs. Plywood gusset plates connect the rafters at the peak. The flooring provided is 19 mm thick plywood. Roofing is of tempered hardboard coated with water proofing compound.

Sidings used include tempered hardboard, 25 mm x 100 mm wood siding, and asbestos sheets. Like Flexihome model 40.32, this model utilizes the space underneath the roof as a room (attic).

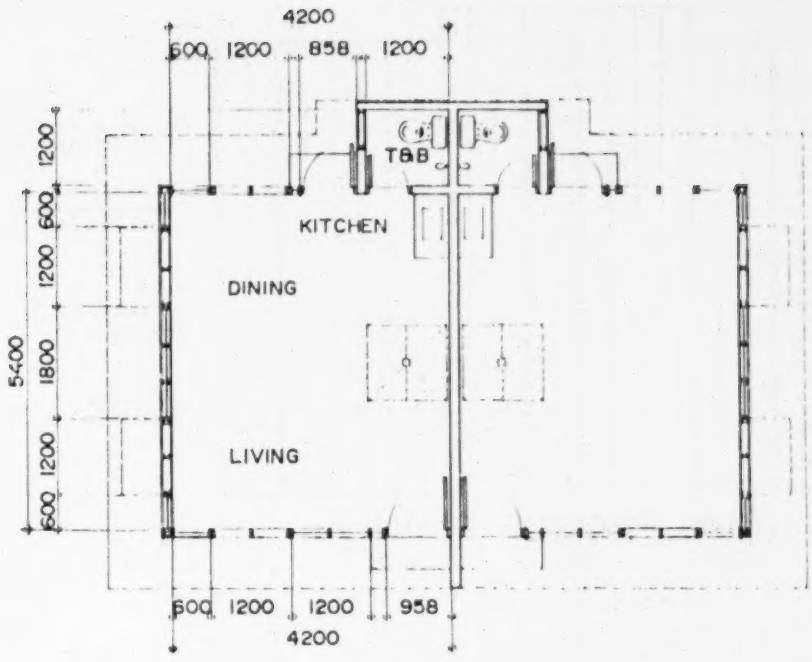
FLEXIHOME MODEL 36

This model is a 36 sq. m. bungalow with walls originally made of concrete hollow blocks. Timber was introduced as the price of steel reinforcing bars and cement increased excessively. Again, for market acceptability, it was important to provide a concrete hollow block wall up to the height of the window sill.



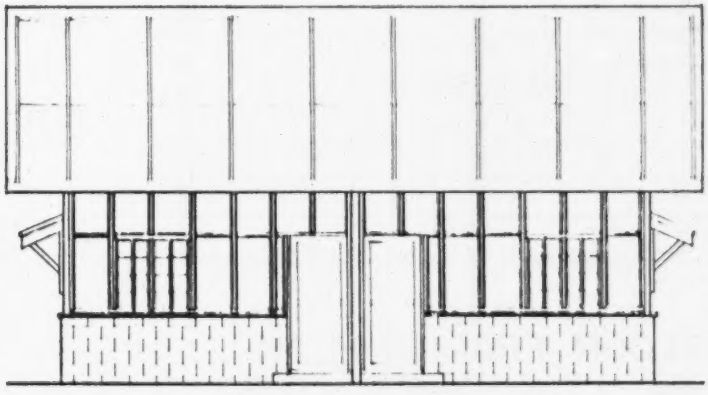
Flexihome Model 46.8

Flexihome Model 46.8

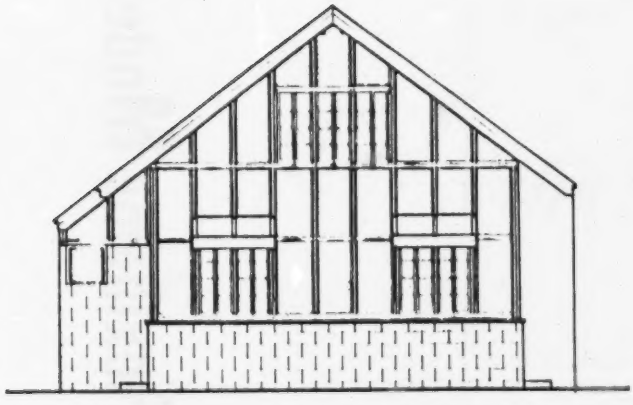


FLOOR PLAN

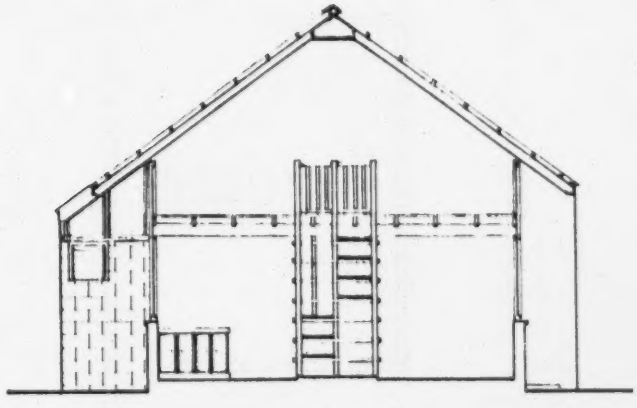
1.0 0.5 0 1.0 2.0M.



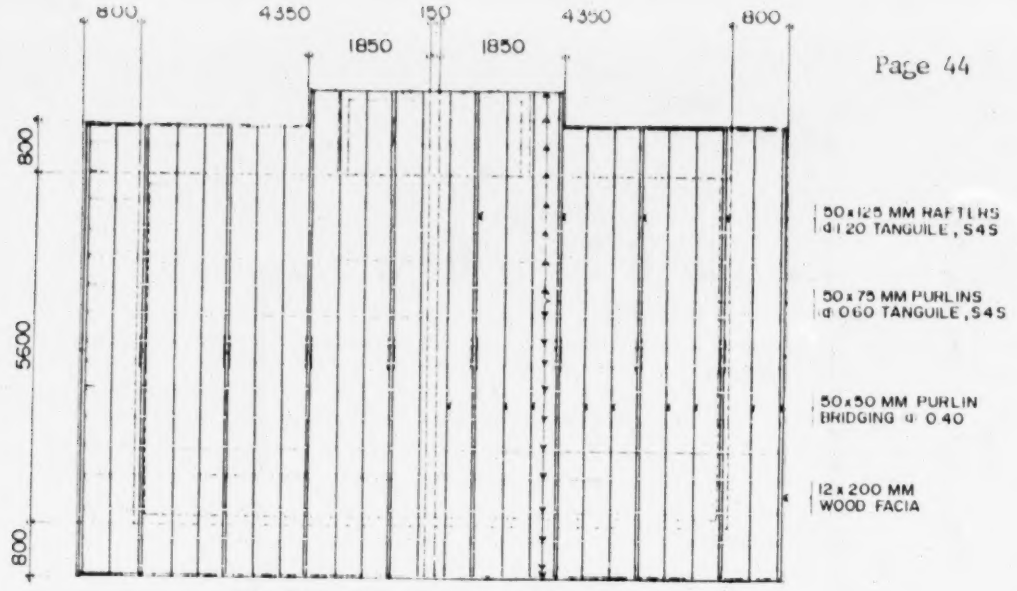
FRONT ELEVATION



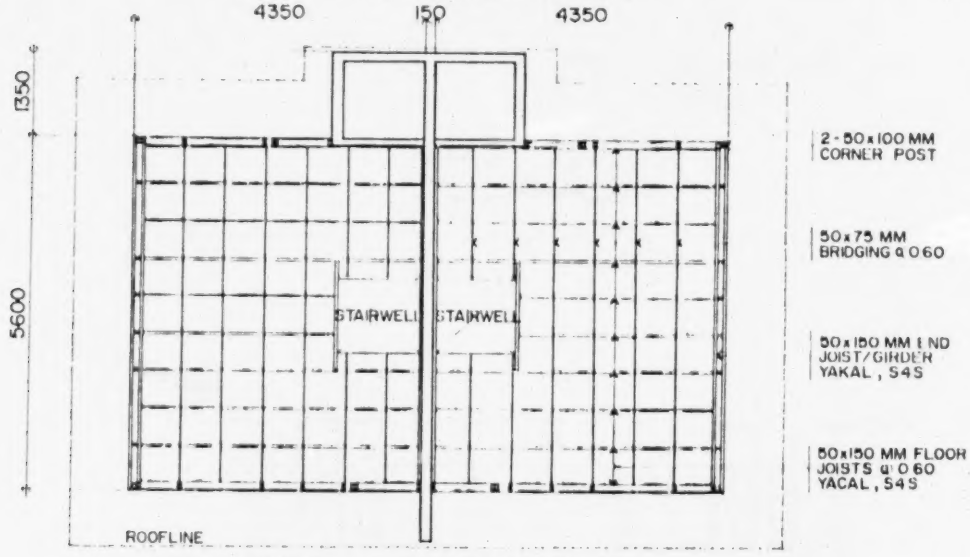
LEFT SIDE ELEVATION



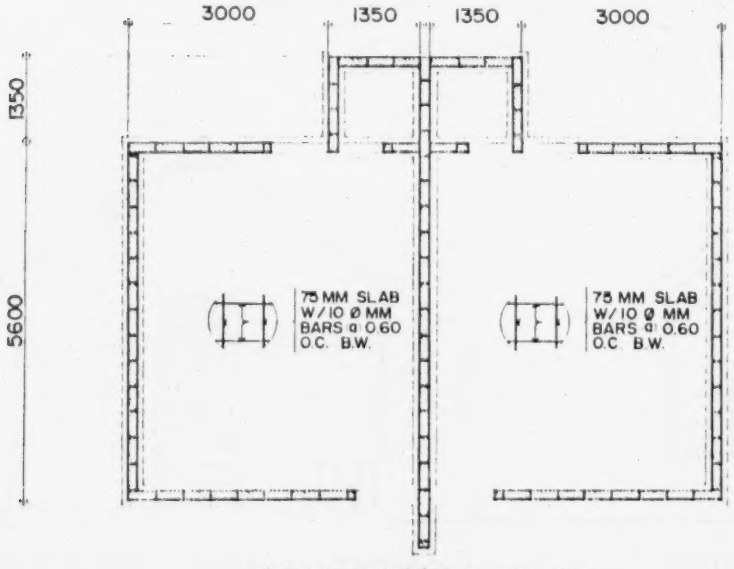
LONGITUDINAL SECTION



ROOF FRAMING PLAN



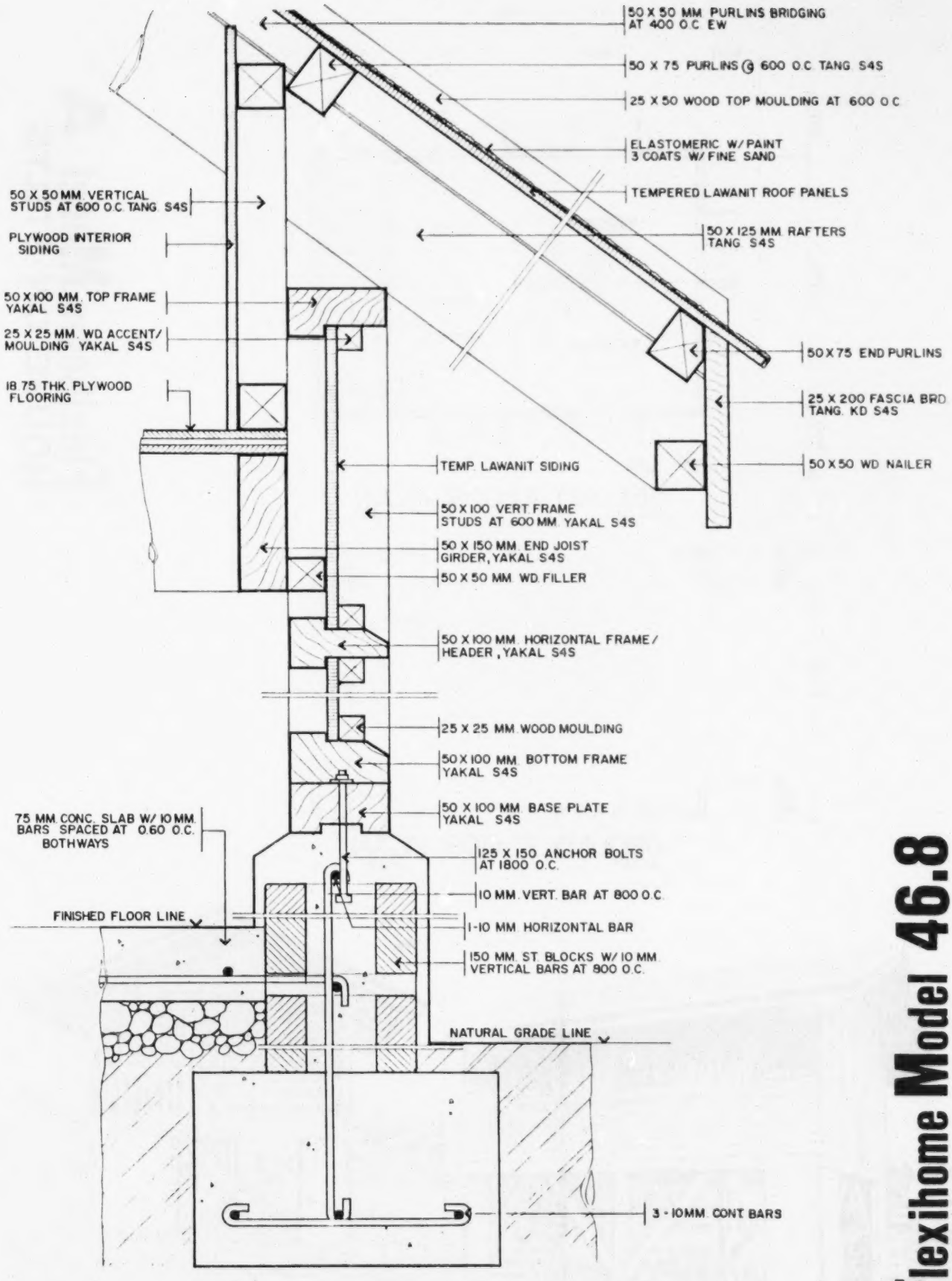
FLOOR FRAMING PLAN



FCUNDATION PLAN

10 05 0 10 20 30M

Flexihome Model 46.8

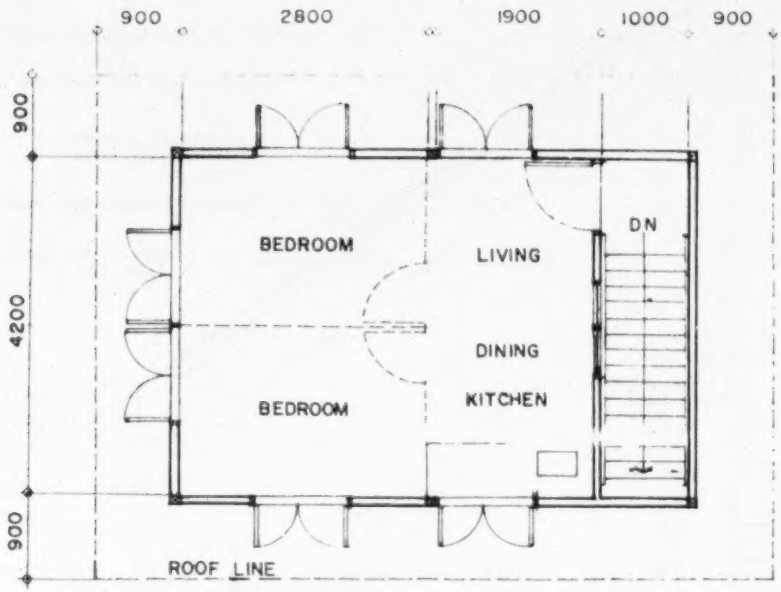

50 X 50 MM. PURLINS BRIDGING AT 400 O.C. EW
50 X 75 PURLINS @ 600 O.C. TANG. S4S
25 X 50 WOOD TOP MOULDING AT 600 O.C.
ELASTOMERIC W/ PAINT 3 COATS W/ FINE SAND
TEMPERED LAWANIT ROOF PANELS
50 X 125 MM. RAFTERS TANG. S4S
50 X 75 END PURLINS
25 X 200 FASCIA BRD. TANG. KD S4S
50 X 50 WD. NAILER
50 X 50 MM. VERTICAL STUDS AT 600 O.C. TANG. S4S
PLYWOOD INTERIOR SIDING
50 X 100 MM. TOP FRAME YAKAL S4S
25 X 25 MM. WD. ACCENT/ MOULDING YAKAL S4S
18 75 THK. PLYWOOD FLOORING
TEMP. LAWANIT SIDING
50 X 100 VERT. FRAME STUDS AT 600 MM. YAKAL S4S
50 X 150 MM. END JOIST GIRDER, YAKAL S4S
50 X 50 MM. WD. FILLER
50 X 100 MM. HORIZONTAL FRAME / HEADER, YAKAL S4S
25 X 25 MM. WOOD MOULDING
50 X 100 MM. BOTTOM FRAME YAKAL S4S
50 X 100 MM. BASE PLATE YAKAL S4S
75 MM. CONC. SLAB W/ 10 MM. BARS SPACED AT 0.60 O.C. BOTHWAYS
125 X 150 ANCHOR BOLTS AT 1800 O.C.
10 MM. VERT. BAR AT 800 O.C.
FINISHED FLOOR LINE
1-10 MM. HORIZONTAL BAR
150 MM. ST. BLOCKS W/ 10 MM. VERTICAL BARS AT 800 O.C.
NATURAL GRADE LINE
3 - 10MM. CONT. BARS

WALL SECTION

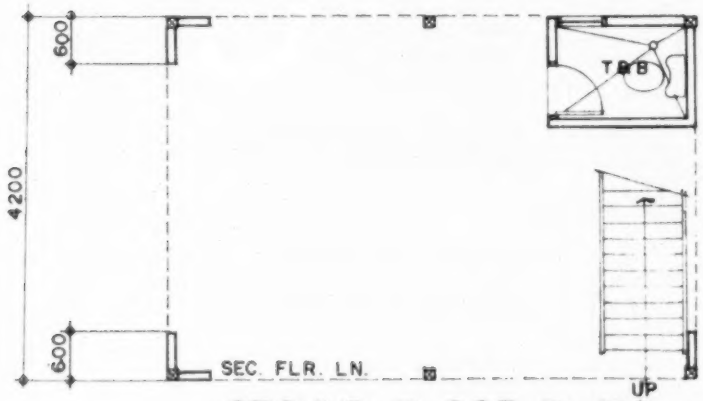
0.05 0 0.20
0.10 0.10 M18

Flexihome Model 46.8

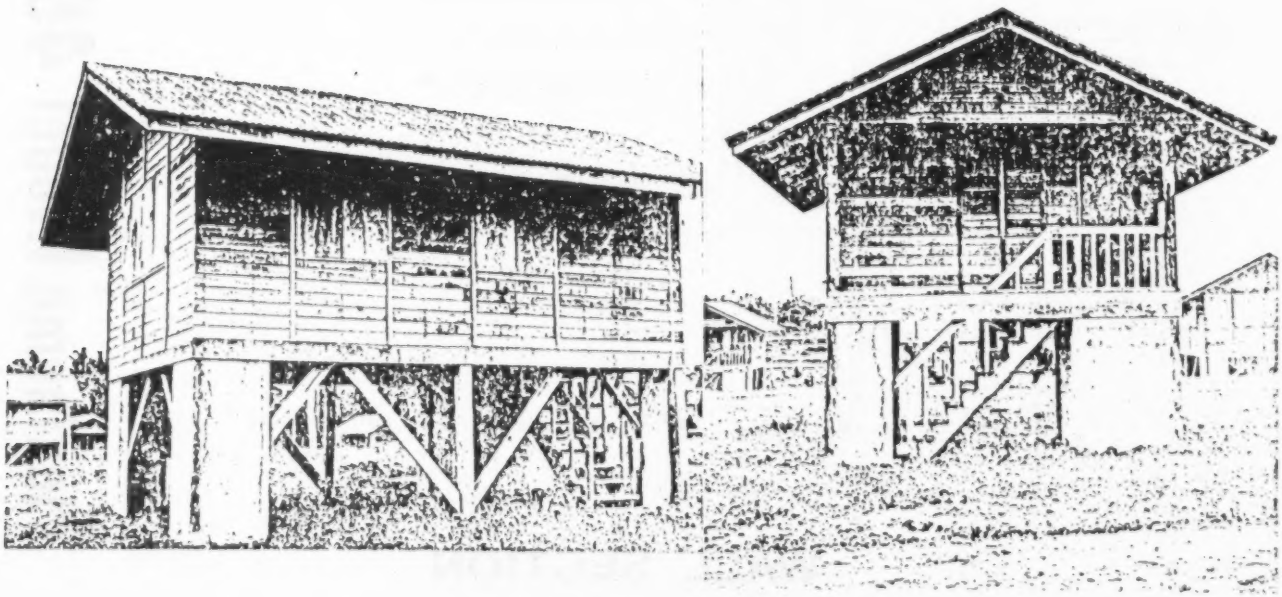
Flexihome Model A
HOUSE ON STILTS



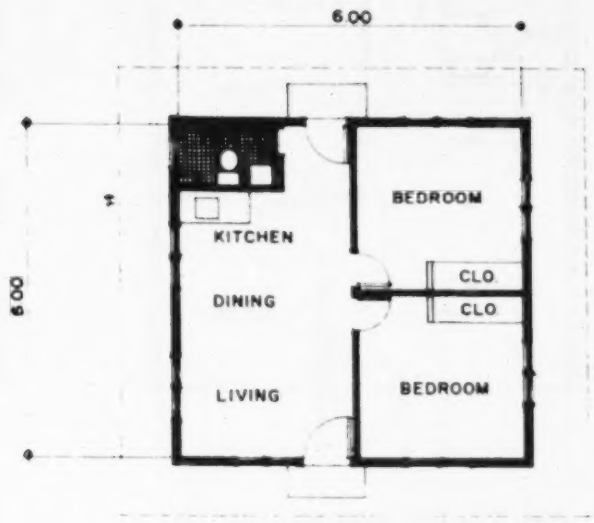
SECOND FLOOR PLAN
SCALE: 1:80



GROUND FLOOR PLAN
SCALE 1:80

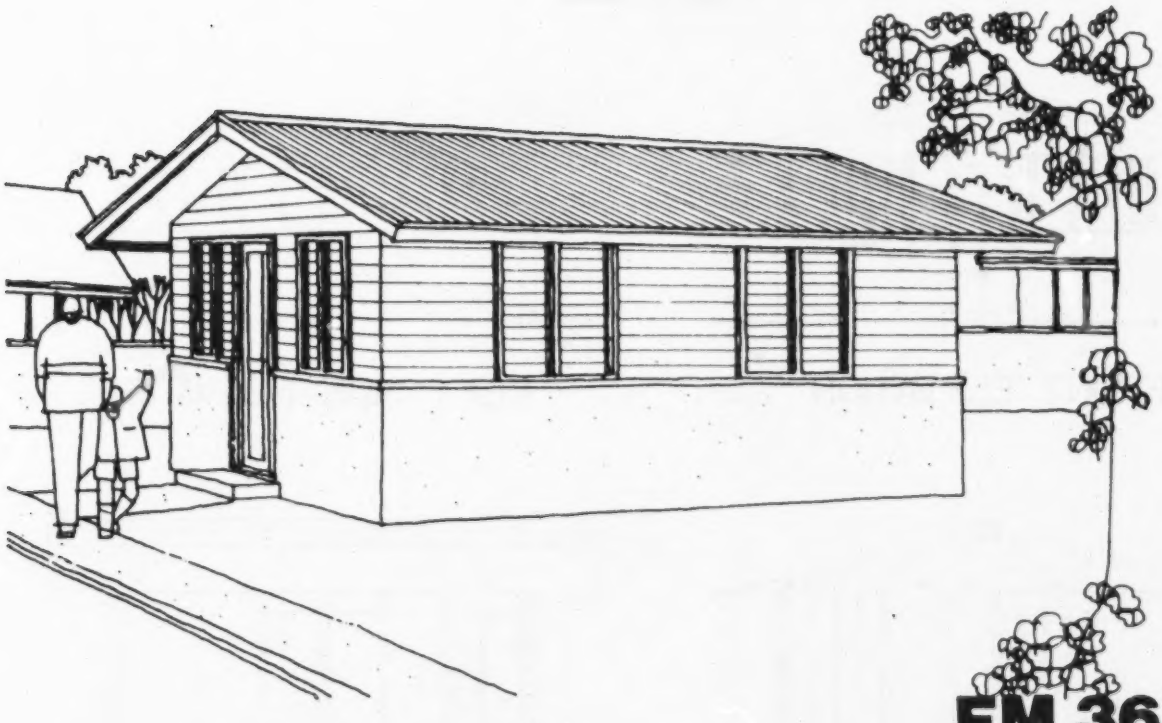


Flexihome Model



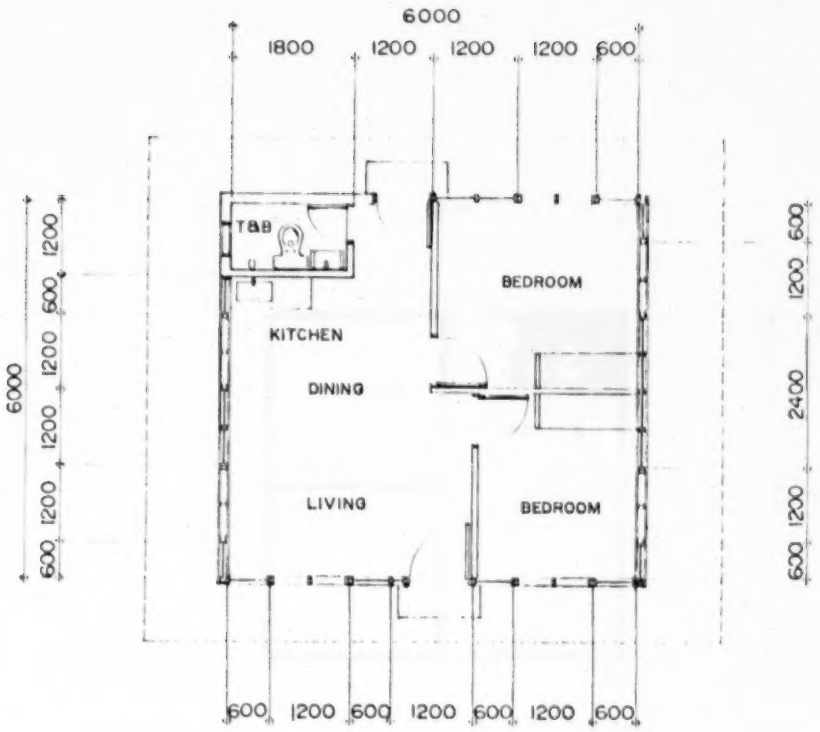
FLOOR PLAN

0 1.00 2.00



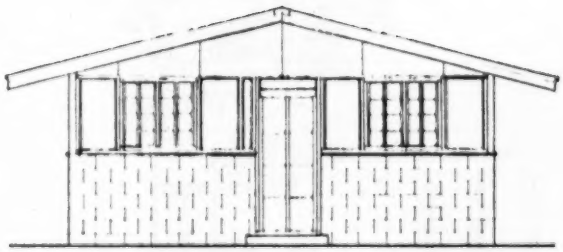
FM 36

Flexihome Model 36

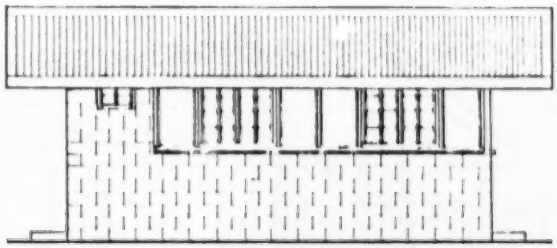


FLOOR PLAN

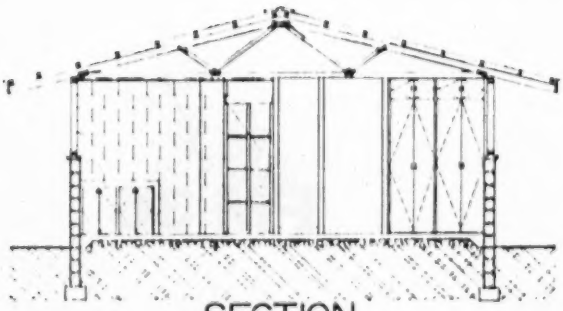
1.0 0.5 0 1.0 2.0 M.



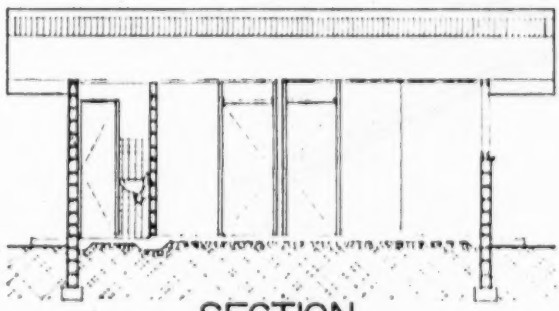
FRONT ELEVATION



LEFT SIDE ELEVATION



SECTION



SECTION

SARILING SIKAP

The continued deterioration of the economy onto the second half of 1985 has resulted in a very sluggish performance in shelter production. High interest rates and limited financing at the buyers' end have caused the developers to pose a wait-and-see attitude to the detriment of the National Shelter Program.

To stop construction altogether with a big housing backlog already estimated between one and three million certainly would wipe out the modest gains of the National Shelter Program. Aware of this consequence, the government has adopted self-help housing as a strategy for low-income housing wherein partially built units (core houses) are sold to homebuyers which shall be completed through their own initiative. Self help housing has been successfully implemented in other countries and similarly, it has been one of the strategies of the National Housing Authority (Philippines) in its socialized and slum upgrading program.

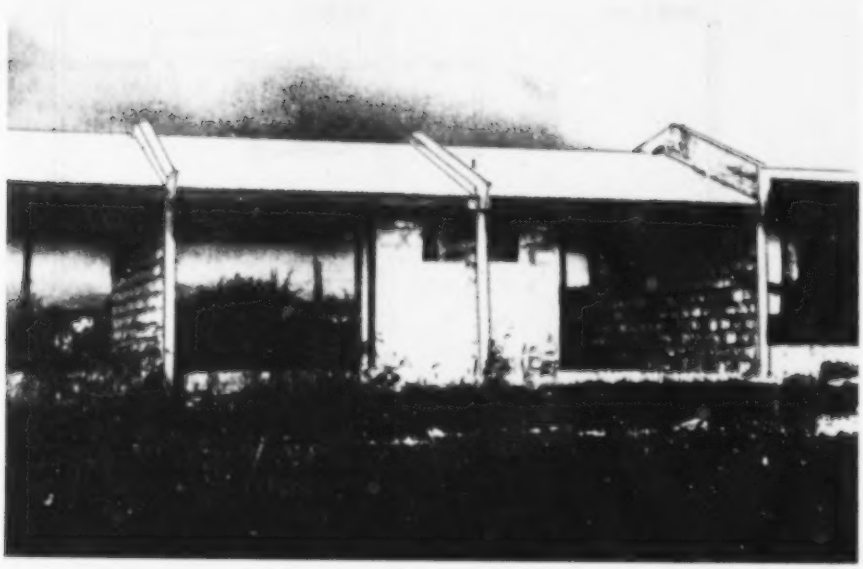
The program offers the following packages:

1. Serviced lot -- these are subdivided plots with access roads, water supply, sewer and drainage lines, and power (electric) lines. The dwelling unit is similarly constructed by the buyer.
2. Serviced lot and Sanitary Core - - in addition to the lot the buyer is also provided with basic toilet and bath facilities. The dwelling unit is similarly constructed by the buyer.

3. Serviced lot and core house - - in addition to the serviced lot and sanitary core, a core house is provided consisting of all structural elements (posts, columns, footings, roof framing) the roofing and the party walls (for duplex and rowhouse units), and electric service entrance connections. The house at this stage, is not yet habitable.
4. Serviced lot and Habitable House - - The unit provided is a maximum 20-square meter-unit without finishes but liveable. The buyer expands the house progressively as his economic situation improved.

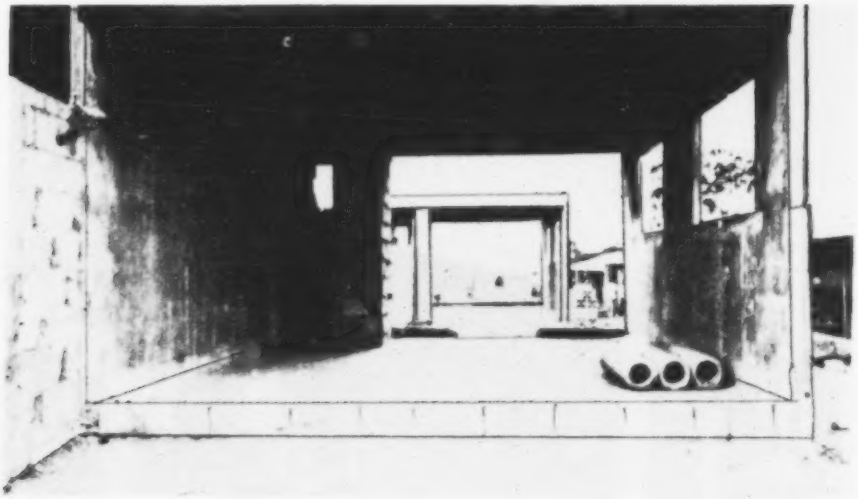
The succeeding illustrations show the various schemes designed for the program. Expansion is either at the front or rear, and in some models also upward. Prefabricated wood panels are envisioned for the self-help portion of the dwelling unit.

To date, one private project and one government project with a combined total of over eight hundred dwelling units are about to be completed. In times of need and economic difficulty, self-help housing has proven to be acceptable as exemplified in these two projects which have received as many as ten applicants per core house available.

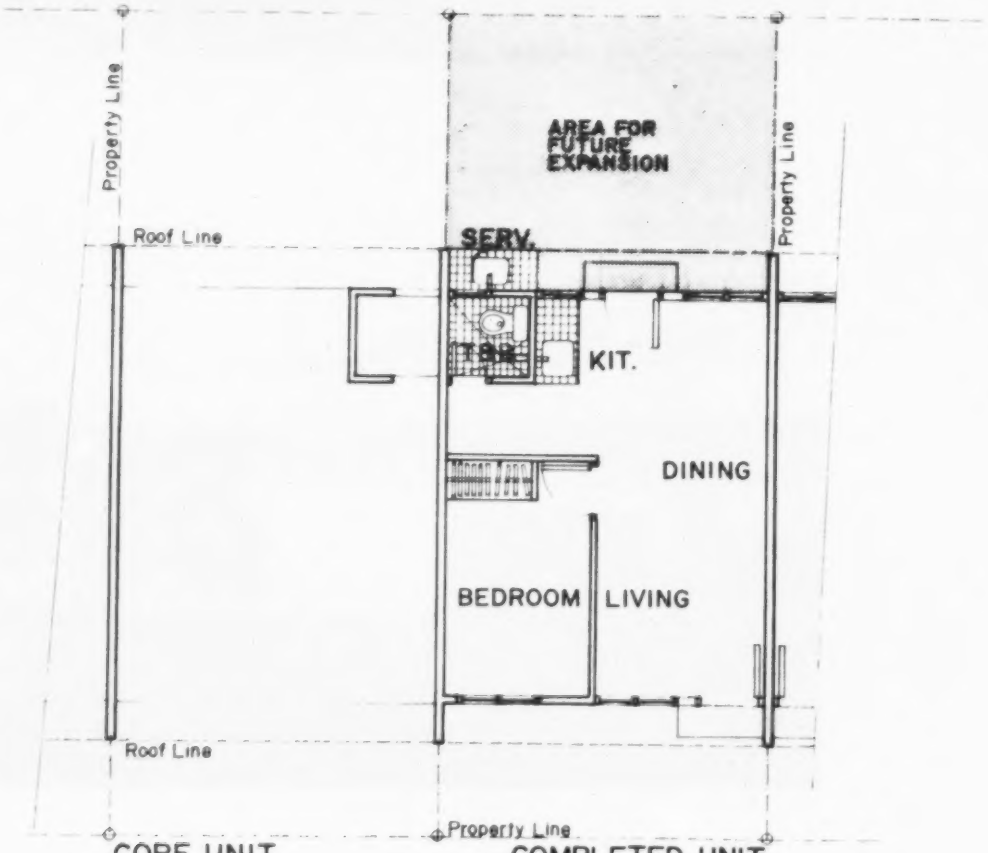


SARILING SIKAP HOMES

Completed core houses include posts, beams, roof framing and roofing and toilet and bath facilities.



PERSPECTIVE



CORE UNIT COMPLETED UNIT

FLOOR PLAN
SCALE: 1:100

LOT SIZE : 58.00 SQ.M
DWELLING UNIT SIZE : 28.80 SQ.M (4.80x6.00)

ROWHOUSE

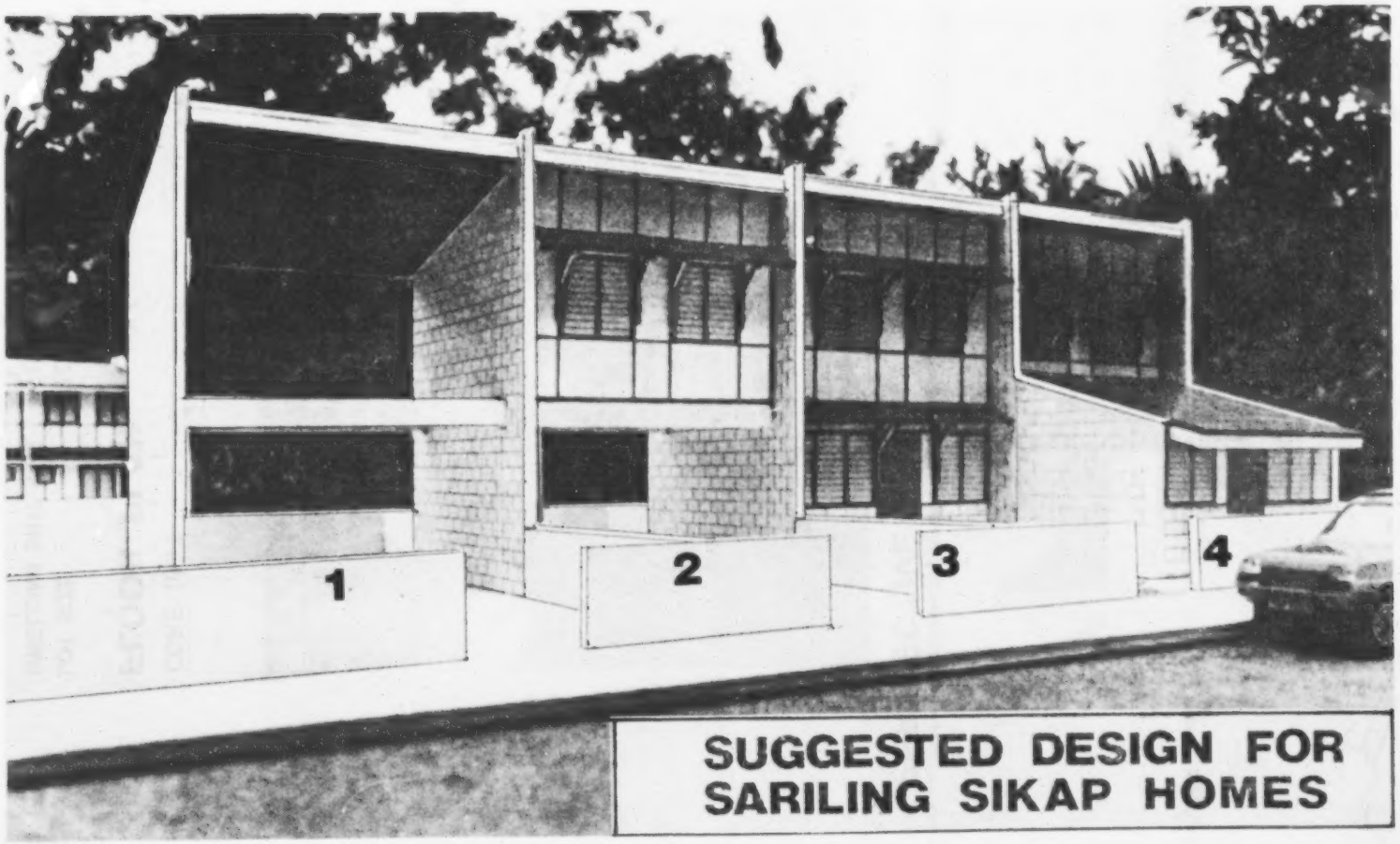
SUGGESTED DESIGN FOR SARILING SIKAP HOMES

1. CORE HOUSE
   * PARTY WALLS
   * ROOF FRAMING & ROOFING
   * SANITARY CORE
   * FLOOR SLAB

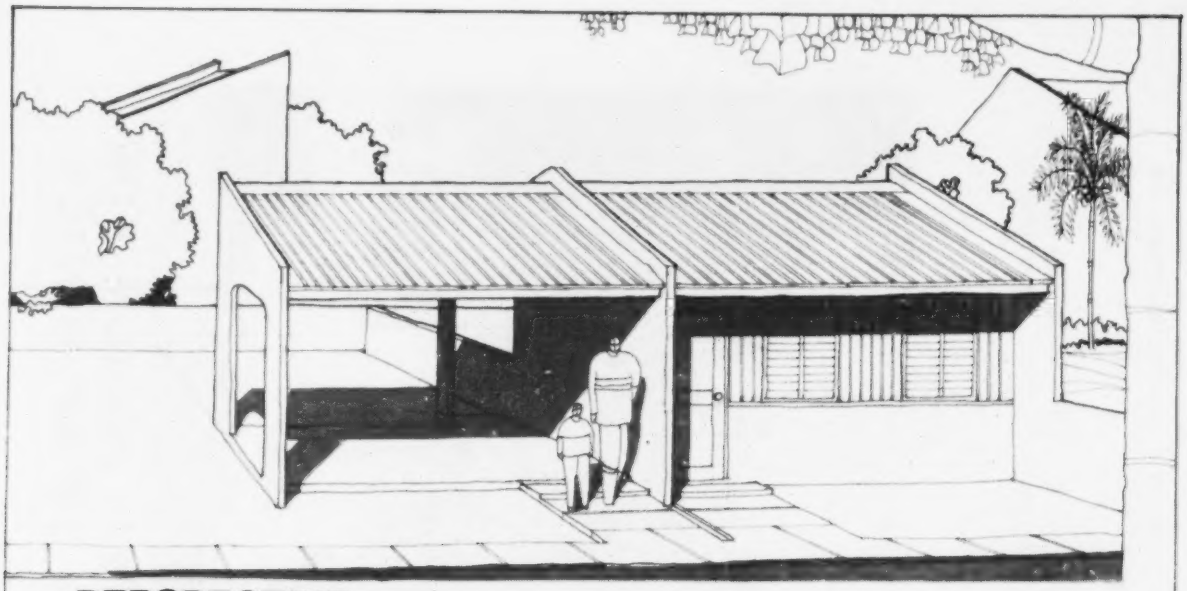
2. FIRST STAGE OF SARILING SIKAP
   * COMPLETED SECOND FLOOR

3. SECOND STAGE OF SARILING SIKAP
   * COMPLETED FIRST FLOOR

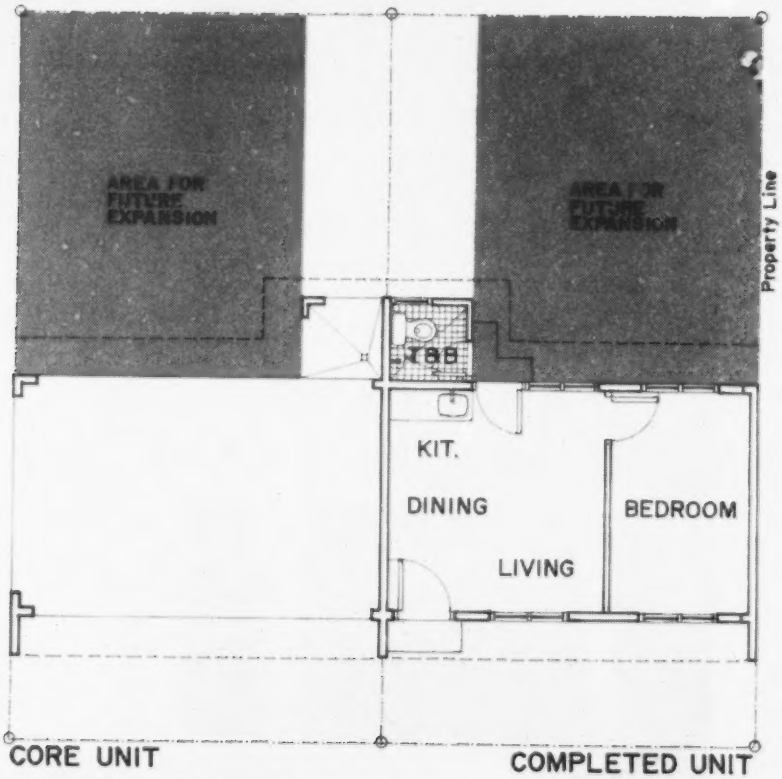
4. THIRD STAGE OF SARILING SIKAP
   * FIRST FLOOR EXPANDED



SUGGESTED DESIGN FOR SARILING SIKAP HOMES



PERSPECTIVE



FLOOR PLAN

LOT SIZE : 72.0 Sq.M (6x12M)
DWELLING UNIT SIZE : 24.0 Sq.M (4x6M)

DUPLEX / ROWHOUSE	**SUGGESTED DESIGN FOR SARILING SIKAP HOMES**

CLIMATIC FACTORS

Climatic factors influencing the design and construction of houses is very much more manifested in traditional houses, than in modern homes where technological advances have made it possible to alter and control the environment inside the house.

In tropical countries, heat and humidity are major factors to contend with. Temperature is at its highest in the months from March to May where this may go as high as 38°C (100°F). Average day - time temperature is between 29 to 32°C, while average night-time temperature is between 20 to 24°C.

Annual precipitation averages 2500 mm (100 inches) with some areas receiving as much as 4570 mm (180 inches) of rainfall. Strong winds most often drive the rains almost horizontally and torrential rains are common occurrences as typhoons.

The Philippines lies within the circm Pacific belt where the greatest number of tropical cyclones occur. An average of 19 typhoons hit the country yearly with the greatest frequency in the months of July to September. Ninety seven percent of these originate from the China Sea, with winds blowing anywhere from 100 to 200 kilometers per hour. Except in the southern part of the country which is rarely visited by typhoons, the rest experience tropical cyclones regularly which sometimes leave hundreds of families homeless.

EARTHQUAKES

The country lies in the circm Pacific belt otherwise known as the "Ring of Fire". Its major geologic zone of weakness is the Philippine Rift located between the Eurasian and Philippine plates.

From 1970 to 1980, numerous earthquakes of intensities ranging from II to VIII on the Richter scale have occured. A very devastating earthquake that shock Metro Manila triggered the review and revision of the National Building Code.

LAWS GOVERNING CONSTRUCTION

A number of codes control the development of land for housing and the construction of dwelling units. These are as follows:

1. Presidential Decree No. 957 or "The Subdivision and Condominium Buyers' Protective Decree" is the law regulating the sale of subdivision lots and condominiums. It is aimed at providing a set of land development standards for housing which are applicable nationwide to guide the development of settlements. It also aims to protect the citizens' right as land or condominium buyer from malpractices of the trade.

   Standards promulgated specify that housing projects shall conform with the Land Use Plan and Zoning Ordinance of the locality having jurisdiction over the project. It also specifies: accessibility standards, land allocations, plot planning, minimum community services and utilities required, minimum requirement for open spaces, and density requirements. It specifically sets the minimum dwelling floor area at 36 sq. m. for a household and 26 sq. m. for single occupancy (studio type).

   The Human Settlements Regulatory Commission has been given the responsibility of implementing this law.

   The standards set forth by the decree are rather stringent making it unfeasible for the private sector to provide housing for the low-income wage earners. Recognizing the need to relax some of the existing standards and laws within tolerable limits, the government then enacted B.P. 220 in 1982.

2. Presidential Decree No. 1096 or "The National Building Code" of the Philippines which aims to safeguard life, health, property, and public welfare, provides minimum standards and requirements to regulate and control the location, design, quality of materials, construction, use, occupancy and maintenance of building and structures. The provisions of the code apply to all public and private buildings and structures except traditional indigenous family dwellings, meaning houses constructed of native materials such as bamboo, nipa, logs or lumber, the total cost of which does not exceed fifteen thousand pesos. The enforcement of this code is vested in the Minister of Public Works, Transportation and Communications.

3. "The National Structural Code for Buildings" which complements "National Building Code" is another law governing building design and construction. "Republic Act No. 544, otherwise known as the Civil Engineers Law, empowers the Board of Examiners for Civil Engineers to promulgate rules and regulations deemed necessary to safeguard life, health, and property as related to the design and construction of buildings.

4. Presidential Decree No. 1185 or "The Fire Code of the Philippines" is aimed at safeguarding lives of persons and the loss and damage of properties by fire by promulgating and enforcing fire safety standards, the incorporation of fire safety construction and the provisions of protective and safety devices in buildings and structures. The provisions of the Fire Code apply to

all persons and all private and public buildings, facilities, structures and their premises.

The Director General of the Integrated National Police is given the responsibility and the authority to enforce the Fire Code.

5. Batas Pambansa Building. (National Law) No. 220, is "An Act authorizing the Ministry of Human Settlements to establish and promulgate different levels of standards and technical requirements for economic and socialized housing projects in urban and rural areas from those provided under Presidential Decrees Nos. 957, 1216, 1096 and 1185". Appendix I shows a comparative tabulation of the features of this law and P.D. 957.

The law was enacted to promote and encourage the development of economic and socialized housing projects, primarily by the private sector, in order to make available adequate economic and socialized housing units for average and low-income earners in urban and rural areas.

The standards and technical standards promulgated cover building design and the provision of the following basic services: water, movement and circulation, storm drainage, solid and liquid waste disposal, power and parks/playgrounds. The Ministry of Human Settlements through its regulating arm, the Human Settlements Regulatory Commission, has been given the responsibility and power to implement this law.

The BP 220 has been a great boost to low-cost housing. It has placed under one agency the power of granting land development and building permits for projects categorized within this law's specified standards. Furthermore, it encourages the use of indigenous materials for shelter construction.

CONCLUSION

The political acceptance and the survival of the National Shelter Program depends a lot on its responsiveness to the needs of the greater part of the population -- the low income households. To date housing has been made affordable to some through low rates of interests on long term housing loans, and the reduction of development costs made possible by lowering of building standards through legislation.

Gains in housing have been outpaced though, by a series of economic crises which have consistently put housing costs beyond the reach of low income earners. Turning to indigenous materials for cost reduction is most often the alternative solution presented by planners and policy makers but a number of issues related to this have also to be looked at, which are as follows:

1. DURABILITY OF MATERIALS

Some studies should be made and information disseminated to render indigenous materials more lasting. Materials expected to last for a maximum of 5 years should be confined to non-structural members.

2. COMMERCIAL PRODUCTION

A number of construction materials fashioned from indigenous resources have been developed in third world countries. However, as in the Philippines, commercial production of these materials is yet a thing to be achieved.

3. COST OF MATERIAL

Wood is abundant in the country but not substantially cheaper than the preferred concrete hollow blocks since local needs always have to contend with the more lucrative export

market. Studies have been initiated to identify non-commercial species for construction.

4. EFFICIENT USE OF MATERIAL

While indigenous material such as timber is abundant in the country innovative approaches should be devised to use less of the material. This can be achieved by proper architectural and engineering design.

5. ACCEPTABILITY OF THE MATERIAL

Finally, Mass Media (T.V., Radio, Cinema, etc.) has increased the aspirations and expectations not only of urban dwellers but also of the rural counterpart. As a result, rural dwellers have considered indigenous materials less acceptable especially if amortization is collected for the dwelling units. Similarly, mass media should perhaps now be used to educate prospective homeowners.

COMPARATIVE DESIGN/PLAN FEATURES BETWEEN BP 220 AND PD 957

Appendix 1

FEATURES	B P 220				P D 957		
					MODEL A	MODEL B	MODEL C
PROJECT SIZE - RANGE	Up to 2.50 Has	Above 2.50 Has. to 15 has.	Above 15 has. to 30 has.	Above 30 has.	None	None	None
LAND ALLOCATION	No Fixed Ratio	No Fixed Ratio	No Fixed Ratio	No Fixed Ratio			
Saleable					70%	70%	70%
Common Area					30%	30%	30%
LOCATIONAL CONSIDERATIONS	1) The actual setting of project site shall determine the type and degree of development to be required regardless of political boundaries with respect to this, the degree on level of development shall be defined as follows: A. Undeveloped area - characterized by the absence of utility system or networks, especially water supply, roads and power B. Developed area - characterized by the presence of utility systems or network, especially water supply, roads and power.				1) All cities and Municipalities regardless of class	1) Second class Municipalities and below. 2) As variance in cities and first class Municipalities	1) Third class Municipalities and below 2) As variance in second class Municipalities Or in urban land reform zones or blighted areas
UTILITIES/ FACILITIES A. WATER	a. Undeveloped Area 1) Water Supply must be at least 43 liters per capita per day 2) Provision of communal wells b. Developed Area 1) Water supply must be at least 75 liters per capita per day 2) Public water supply system or independent water supply system				a. Public Water System or Centralized Water Supply System	a. Public Water System or Centralized Water Supply System Water supply must be at least 75 liters per capita per day.	a. Public Water System or communal/individual well Water supply must be at least 43 liters per capita per day.
B. SEWERAGE DISPOSAL	a. The minimum requirement for sewerage disposal shall be the use of septic tank b. Communal septic tanks may be allowed				b. Individual septic tanks; if possible sewer system	b. Individual septic tanks; if possible sewer system	b. Individual septic tanks
C. DRAINAGE	a. Open Canal on each side of the circulation network.				c. Underground, draining into public drainage system	c. Underground, draining into public drainage system	c. Open Canal

Appendix 1 COMPARATIVE DESIGN/PLAN FEATURES BETWEEN BP 220 AND PD 957

FEATURES	BP 220				PD 957		
					MODEL A	MODEL B	MODEL C
D. POWER/ ELECTRICITY	a. Optional, however, developer shall provide sufficient land area for easement for power facilities.				d. Required, primary and alternative source of power.	d. Required, primary and alternative source of power.	d. Optional
E. GARBAGE	a. Shall be undertaken by the local government				e. Undertaken by the subdivision or in conjunction with the local government.		
STREET SPECIFICATIONS							
1. ROW							
a. Major	-	8.00 M	10.00 M	12.50 M	15.00 M	10.00 M	8.00 M
b. Minor	6.50 M	6.50 M	-	-	-	8.00 M	6.50 M
Collector	-	-	8.00 M	10.00 M	12.50 M	-	-
Service	-	-	6.50 M	8.00 M	10.00 M	-	-
c. Alley	3.00 M	3.00 M	3.00 M	3.00 M	-	4.00 M	4.00 M
d. Pathway/ Footpath	2.00 M	2.00 M	2.00 M	2.00 M	4.00 M	4.00 M	4.00 M
e. Sidewalk					Variable according to road class.	Variable	Variable
2. MAX. LENGTH/ DEAD - END							
a. Major					Dead End not allowed	Dead End not allowed	Dead end not allowed
b. Minor	120M (Dead-End) provide for turn around space if 50M or less turn around space not required				-do-	-do-	-do-
Collector					-do-	-do-	-do-
Service					Space for turn around shall be provided	Space for turn around shall be provided	
c. Alley	150M both ends connecting to a minor road, 75M dead end.						Terminus connects to street
d.	100M both ends connecting to an alley, 50M dead end.					Dead end not allowed	-
3. PAVEMENT	Unde'd.	Dev.	Unde'd.	Dev.	Unde'd.	Dev.	Unde'd.	Dev.			
a. Major	Macadam Aggregates	Macadam	Asphalt Aggregates	Macadam	Macadam Aggregates	Macadam	Asphalt Aggregates	Macadam	Conc./Asphalt	Asphalt	Macadam
b. Minor										Asphalt	4" thk. gravel on compacted earth
Collector									Conc./Asphalt		
Service									Conc./Asphalt		

Appendix 1 COMPARATIVE DESIGN/PLAN FEATURES BETWEEN BP 220 AND PD 957

FEATURES	B P 220				P D 957		
					MODEL A	MODEL B	MODEL C
c. Alley	Aggre- gates	Aggre gates	Aggre- gates	Aggre gates	Aggre- gates	Aggre- gates	
d. Pathwalks	-do-		-do-		-do-	Pre Fab Slabs	Pre Fab Slabs	Gravel
e. Sidewalks						CHB/Asphalt	CHB/Asphalt	Gravel
LOT SIZES (Minimum Area)								
a. Detached	72.00 SQM		72.00 SQM		72.00 SQM	100 SQM	100 SQM	100 SQM
b. Semi-Detached	54.00 SQM (Cor. Lot)		54.00 SQM (Cor. Lot)		54.00 SQM (Cor. Lot)	100 SQM	100 SQM	100 SQM
c. Cluster/ Rowhouse	36.00 SQM Inside Lot)		36.00 SQM (Inside Lot)		36.00 SQM (Inside Lot)	50 SQM	50 SQM	50 SQM
BLOCK LENGTH (Minimum)								
a. Bounded by Streets on both ends	4.00M. Block length exceeding 250M but not beyond 400 meters shall be provided by an alley at midlength.					400 M Block more than 250M long shall be provided with an alley at midlength.	400 M	400 M
b. Bounded on both ends by Alleys	150 M		150 M		150 M	Not Allowed	Not Allowed	Not Allowed
c. Bounded on both ends by pathwalks	100 M		100 M		100 M	Not Allowed	Not Allowed	Not Allowed
MININUM LOT FRONTAGE								
a. Single-Detached	8.00 M		8.00 M		8.00 M			
b. -do-	6.00 M		6.00 M		6.00 M			
c. Rowhouse	3.50 M		3.50 M		3.50 M	4.0 M	4.0 M	4.0 M
d. Corner Lot	-		-		-	12.00 M	10.00 M	10.00 M
e. Interior and Thru Lot	-		-		-	10.00 M	8.00 M	4.00 M
f. Irregular	3.50 M		3.50 M		3.50 M	6.00 M	4.00 M	4.00 M

Appendix 1

COMPARATIVE DESIGN/PLAN FEATURES BETWEEN BP 220 AND PD 957

FEATURES	BP 220	PD 957		
		MODEL A	MODEL B	MODEL C
REQUIRED AREA FOR PARK/PLAY-GROUND (% of Gross Area)	a) 3.5% for 150 (and below) lots or living units/hectare b) 7.0% for 151 to 225 lots or living units/hectare c) 9.0% for above 225 lots or living units/hectare	a) 3.5% for 20 (and below) lot or dwelling units/hectare b) 7.0% for 21 to 65 lots on dwelling units/hectare. c) 9.0% for 66 to 100 lots for dwelling units/hectare.		